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XII.

On the Potato as an Article of National Diet, and the Potato Disease in connexion with Distress in Ireland. By J. E. Bicheno, Esq., F.R.S., F.L.S., &c. [*Read 14th March*, 1849.]

For some time past political evils have been but a small element in determining the condition of Ireland. The one great evil has been the almost exclusive cultivation and adoption of the potato as an article of national diet, with a rapid increase of population upon this low and degenerate food. The fearful calamities which have been witnessed of late years in Ireland had long been foreseen by the physiologist and economist as the inevitable results of such a national diet and system of cultivation, and have stamped the potato as the worst species of food for a people. As an adjunct to other and better food, the potato is beyond all praise; but as the chief article of consumption, and sole dependence of the inhabitants of any country, it becomes politically and economically a curse.

The scourge of famine and pestilence which swept Ireland during the years 1845-6-7-8, while it roused England and the British public to the most gigantic efforts at relief, awakened the warmest sympathies of the civilized world, and drew from countries and people alien in race and religion, and in political and social institutions,—from Europe, Asia, Africa, and America—from the Christian, the Moslem, and the Hindoo,—large and repeated contributions in aid. It was, perhaps, the first instance of the treasury of the world being poured into the lap of one unhappy land, to succour the necessities and mitigate the sufferings of its starving and plague-smitten inhabitants.

But nothing could stay the march of famine and pestilence: the means of relief afforded in 1845-6 seemed rather to increase than allay distress. All sense of self-reliance seemed to be lost; and the gentry, converting the world's benevolence to private emolument, were known to have placed their tenants on the roll of relief to obtain their rents: while, in 1846-7, the tenantry, before putting in their crops, said they would wait till it should be seen what Government would do—expecting that their labour in tilling their own ground would have been taken as relief work, and that their crops would have been literally planted for them. The failure of the crop in 1846-7 was followed by an entire change in the mode of relief,—the burden was thrown upon local funds administered by local functionaries; and the British Government, declining to take the initiative in any case, played the part of an able, willing, and munificent auxiliary to those who would help themselves.

In 1847-8, the crop again failed; but famine and pestilence had now swept away the people by millions, and the remainder were more easily dealt with.

It is to be hoped that a visitation of Providence so signal and protracted may yet be rendered a blessing to Ireland, by inculcating and graving deeply on the minds of its people how great and urgent the necessity is that, in future, they should seek their subsistence as a nation in some other article of food besides the potato.

The native country of the potato, *Solanum tuberosum,* is tolerably well ascertained to be the cold regions of the Cordilleras, in South America. Darwin, in his "Naturalist's Voyage," chap. 13, page 285, speaks of the potato being indigenous, as a littoral plant, on the *Chonos Archipelago*— "Having run up the coast, we anchored near the northern end of the Chonos Archipelago, in Low's Harbour, where we remained a week. The islands were here, as in Chiloe, composed of a stratified, soft, littoral deposit; and the vegetation was, in consequence, beautifully luxuriant. The woods came down to the sea-beach just in the manner of an evergreen shrubbery over a gravel walk. We also enjoyed from the anchorage a splendid view of four great snowy cones of the Cordillera, including '*el famoso Corcovado.*' The range itself had in this latitude so little height, that few parts of it appeared above the tops of the neighbouring islets. We found here a party of five men from Caylen, '*el fin de Christiandad,*' who had most adventurously crossed in their miserable boat-canoe for the purpose of fishing the open space of sea which separates Chonos from Chiloe. These islands will, in all probability, in a short time become peopled like those adjoining the coast of Chiloe.

" The wild potato grows on these islands in great abundance, on the sandy shelly soil near the sea-beach. The tallest plant was four feet in height. The tubers were generally small, but I found one of an oval shape two inches in diameter. They resembled in every respect, and had the same smell as, English potatoes; but when boiled they shrunk much, and were watery and insipid, without any bitter taste. They are undoubtedly here indigenous; they grow as far south, according to Mr. Low, as lat. 50°, and are called Aquinas by the wild Indians of that part. The Chilotan Indians have a different name for them. Professor Henslow, who has examined the dried specimens which I brought home, says that they are the same with those described by Mr. Sabine;* but that they form a variety which, by some botanists, has been considered as specifically distinct. It is remarkable that the same plant should be found on the sterile mountains of central Chile, where a drop of rain does not fall for more than six months, and within the damp forests of those southern islands."

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* Horticultural Transactions, vol. 5, page 249.—Mr. Caldcleugh sent home two tubers, which, being well manured, even the first season produced numerous potatoes, and an abundance of leaves. See Humboldt's interesting discussion on this plant, which, it appears, was unknown in Mexico,—in Polit. Essay on New Spain, book 4, chap. 9.

The localities in which *Statice, Armeria* and some other plants are found are apparently as dissimilar; and the distribution we may suppose to be dependent upon physical condition—it may be of moisture—of the atmosphere, and of the soil around, closely approximating to identity in such cases.

The first American settlers, sent out by Sir Walter Raleigh in 1584, found the potato in Virginia; and probably carried it to England with them on their return in 1586 with Sir Francis Drake. Mr. Thomas Harriot, who in 1579 took the degree of B. A. at St. Mary's Hall, Oxford, and was mathematical tutor to Sir Walter Raleigh, accompanied Sir R. Grenville to Virginia in 1585; in his "brief and true Report of the new found land of Virginia, of the commodities there found and to be reared, &c.," published in 1588, mentioned the potato under the *Indian* name *Openawk,* as having the roots round, and "hanging together as if fixed on ropes," and as "good for food, either boiled or roasted."

Gerarde grew the potato in his garden at Holborn in 1590, and published his herbal in 1597, giving a figure and description of the plant, recommending it as a conserve to be eaten "sopped in wine."*

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* Gerarde, in his "Second Booke of the Historie of Plants," chap. 334, and pages 780 and 781, says of the sweet potato, or as he terms it "*Battata Hispanorum*"—"These rootes may serve as a ground or foundation whereon the cunning confectioner or sugar baker may worke and frame many comfortable and delicate conserves and restorative sweetmeats.

"They are used to be eaten rosted in the ashes; some, when they be so rosted infuse them, and sop them in wine: and others, to give them the greater grace in eating, do boile them with prunes and so eate them; and likewise

But some years before the introduction of the present root into England, another bearing a resemblance to it had been brought into the gardens—the *Convolvulus Battata*—(*Battatas edulis*) or sweet potato as we now call it, an inhabitant of a warmer climate, and very inferior in farinaceous matter. Spain received this from her Colonies on the eastern shores of Central America 40 years before the former, which belonged to the western side, and was called by the Spaniards *Batata:* its resemblance to the *Solanum tuberosum* led doubtless to the employment of our word potato as a name for both.

The sweet potato is the potato of Shakspeare, who, in his *Merry Wives of Windsor,* makes Falstaff call upon "the sky to rain potatoes," as a provocative to love; and in *Troilus and Cressida* there is a similar allusion to its virtues. In a cookery book of 1596, "the Good Huswife's Jewel," there is this recipe—"Take 2 quinces, 2 or three burr roots, and a potato, put them in a quart of wine, and let them boil till they be tender, draw them through a strainer, and put the yolks of 8 eggs, and the brains of 3 or 4 cock sparrows, and then you have a tarte that is courage to a man," &c., all which applies to the sweet potato.

America has contributed to the common stock of comforts

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others dress them (being first rosted) with oile, vineger and salt, every man according to his own taste and liking; notwithstanding however they be dressed, they strengthen, nourish, and comfort the bodie, &c."

Of our potato, which he terms "Battata Virginiana, and Pappus," he says at pages 781 and 782:—"The roote is thicke, fat, and tuberous; not much "differing either in shape, colour or taste from the common potatoes, saving "that the rootes hereof are not so great nor long; some of them round as a "ball, some ovall or egge fashion, some longer and others shorter: which "knobbie rootes are fastened unto the stalkes with an infinite number of "threddie strings."

He adds—"The temperature and vertues are referred unto the common "potatoes; being likewise a foode as also a meate for pleasure equall in "goodnesse and wholesomenesse unto the same, being either rosted in the "embers or boiled and eaten with oile, vineger and pepper, or dressed any "other way by the hand of some cunning in cookerie."

belonging to civilized life four most useful and agreeable articles—the potato, tobacco, maize, and the turkey; and also, it is said, two most serious pests, the potato blight and the apple blight, both pertaining to the genus *Aphis,* or plant-louse—a genus not more remarkable for its extreme fecundity than for the singular fact disclosed by the researches of entomologists, that one sexual congress is sufficient to propagate numerous generations of *Aphides.* The ravages of the apple blight seem to have been first noticed in a nursery in Sloane-street, London, into which apple trees from North America were imported in 1787.

History would scarcely have suffered any material incident in the account of a battle to have perished; yet the name of him to whom we are indebted for the potato,—which has spread over the globe from Hammerfest, in Lapland, about 71° north latitude, to Van Diemen's Land, 40° south, and become an indispensable article of diet for all the races of men,—has found no record.*

Even Spain and Portugal, countries the least disposed to improvement, have at length adopted the potato as an article of subsistence; for, though they were the earliest to introduce it from their colonies, they have been the last to cultivate it. I quote from a friend's letter just received:—

"I spent six months in Portugal, which country is quiet enough (no small matter in these times); the Government insolvent and powerless, and the law of no force beyond the neighbourhood of the large towns: and yet the interior thriving after its fashion, as if to show us how little government is required. I made two trips on horseback from Lisbon to Oporto, deviating a good deal from the high road, and spending some time in the country, and found the people with an appearance of comfort I hardly expected. Perhaps comfort is too strong a phrase, at least it must not be understood in the English sense. The country has advanced a good deal since I went there fifteen years ago; much more land is under cultivation, so that instead of *importing* they *export* grain. The potato has been introduced since my last visit, and is now a great part of the staple food of the people. I believe that Spain also has been improving, and even faster than Portugal, notwithstanding," &c. &c.

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* Sir George Simpson mentions having found potatoes in a lodge of Pend d'oreille Indians, not far from the sources of the *Columbia* river, and nearly in the line of the Rocky Mountains.—"In one of their lodges we were surprised to find several baskets of potatoes; and, in answer to our inquiries on the subject, we were shown two patches of ground where they had been produced; the seed and implements having been supplied from Fort Colville."—Vol. 1, page 144,—*Journey round the World.*

To Sir Walter Raleigh, under whose auspices the first but fruitless settlement in Virginia was planted, is attributed the introduction of the potato into Ireland. Sir Walter's intrepid spirit, and his love of enterprize, induced Elizabeth to reward him with a grant of 50,000 acres of land in Cork and Waterford, which he afterwards forfeited by getting into disgrace with his capricious Queen: his estate was subsequently divided between three noble families, which survive to the present day—*Cork, Burlington,* and *Devonshire,*—yielding an ample competence to each. Youghal, Bandon, Dungarvon, and Lismore are the centres from which the potato has been disseminated throughout Ireland.

In the opinion of some, all or most of the evils which have fallen so heavily from time to time on the mass of the population in Ireland are attributable to the cultivation of the potato, and to its general and almost exclusive consumption as an article of food; while others look upon its introduction among the greatest boons bestowed by Providence upon the exigencies of man. It seems certain that the potato, when relied upon as the sole subsistence of a community, exposes it to more casualties than probably any other cultivated plant which forms a national diet. I am not aware of any other instance in which a root has become the staple and almost the only food of a nation; neither the yam nor sweet potato are used to this extent. The *tapioca* plant, which yields a very important article of food in the tropical parts of America, and the *arum,* employed as a common diet in the South Sea Islands, are by no means the sole diet; they have in America beef, besides flesh of the guanaco and ostrich, several varieties of deer, bear's flesh, &c.; and in the Isles of the South Sea, they have the yam, the banana, the *arum,* and bread-fruit, with the flesh of the pig superadded.

The single vegetable which sustains, without doubt, the largest number of human beings is the rice plant; the myriad labouring classes of India and China are thus supported: and although rice is much less subject to failure than the potato, yet the main dependence for food being upon a single article, causes the countries in which it prevails to be exposed to the most fearful visitations of famine and pestilence. As a proof of the wide range of excess and of failure of crop to which the potato is subject, it may be mentioned that, in years of scarcity, it has been known to be ten times as dear as in seasons of plenty; whereas the range of wheat does not exceed two, or at most three, times its average rate in modern cultivation. The failure of the potato crop has been more frequent of late than in former years. Within the last twenty years, the following may be taken as years of partial or wide-spread failure:—1831, 1835, 1836, 1837, and 1839. The potato disease, which had appeared in North America in 1844, showed itself in Ireland in 1845, increased in 1846, was of milder type in 1847, and returned with greater virulence in 1848. The causes thereof are several. Population has increased, and consumption has been proportionally augmented; it has been necessary, in consequence, oftener to repeat the crop in the same ground, and the soil has become exhausted of the peculiar elements essential to the reproduction of the plant. The extraordinary success with which its cultivation is attended in fresh virgin soil, such as a new colony affords, sufficiently attests this point. The poverty of the people of Ireland has increased with their numbers, while their means of cultivating to the best advantage has diminished in an opposite ratio: again, this pressure upon the poorer and most numerous class of cultivators has tempted them to rear inferior varieties of the plant—such as the "lumper," the "ox-noble," and other cattle potatoes.

I think that the frequent repetition of these years of scarcity and famine serve to point to a still different cause of failure: one having even a more general influence, as affecting more intimately and vitally the plant itself—one which scarcely appears to have been noticed, except by some of the more distinguished horticulturists—one which we more especially have it in our power to assist in obviating, and to which, therefore, I would particularly draw the attention of members of this Society. It is now pretty well established as a law in cultivation, that there is a point beyond which it cannot be carried without occasioning the plant or flower to produce monsters, or to become unhealthy and die off. This is particularly the case in plants propagated by offsets, grafts, or from the roots. Where a new progeny is produced from seed, the cause of failure is not so apparent; the cereal plants, which have been cultivated for thousands of years, seem to possess the same fecundity as ever. Nations living on *rice*, and which has been their diet beyond all record,—India and China for instance,—are not subject to loss of crop, and their staple article of food, so frequently as the Irish. The gardener knows full well that, in the case of apples, the old sorts—such as the golden pippin, the nonsuch, the pearmain—have disappeared; and there is very little doubt that the theory of the late Mr. Knight, of Downton, President of the Horticultural Society, was well founded—namely, that propagation by graft is only the perpetuation of the individual. All apples increased by this method after a time die away; and so in the case of pinks and tulips, and all tubers, they die off. Early varieties of the dahlia even are not to be prolonged—partly, no doubt, because the gardener finds his advantage in raising new sorts; but partly, also, because old varieties disappear from the operation of natural laws. It is a fact well known that the American blight, so destructive to apple trees, attacks old sorts, and that some varieties are free from them. Reasoning upon analogy, there can be little doubt that, to continue to grow good healthy potatoes, we should be prudent in resorting to seed from time to time. I know that it may be objected that the vine has been propagated from cuttings for thousands of years, yet shows no deterioration: it is a sufficient answer for me, that in most plants the rule seems to be otherwise,—and this may be an exception.

Many plants are selected by the florist and horticulturist because of their sporting tendencies. The potato is a plant of versatile disposition—how else could it be believed that the "ox-noble" is the same species as the "ash-leaved kidney?"

Now, it seems very desirable that in this new country some new varieties of potatoes should be raised from seed; and it ought not to be left in the hands of the market-gardener, whose interests, however obviously they may lead him to cultivate a favourite sort, whose excellence is well known and acknowledged, are just as plainly opposed to the great loss of time, attention, and labour involved during several years spent in bringing the tuber to a sufficient size, in ascertaining its value, and establishing for it a character and reputation. In the case of such new produce, it must be indubitably established that *it is* from seed—a cardinal point not to be entrusted to any one who is to make money by it. The experiment should, therefore, be undertaken by gentlemen who look for no recompense, and whose sole object is to confer a benefit on their country and their fellow-man. Still, more especially, does it appear to me to fall within the province of this Society to conduct such an experiment: we have a virgin and not ungenerous soil—our climate is most favourable to the plant—we have every means and appliance at command; and I am very confident that there lacks not amongst us a disposition animated by the highest motives.

I now produce to the meeting sections of the *leaf*, and of the *tuber*, of the potato affected by disease as it exists in Ireland, and also of the insects to which the mischief is attributed, for examination through my microscope under a high magnifying power. I am sceptical as to the disease originating with the *Aphis;* it seems to me more likely that the insect is the effect, than the cause. Disease and decay have two concomitants, fungi and insects, one or both. In England the notion is, that this *Aphis* (a species well known to the gardener) is brought by the east wind. It is a notorious fact, that winds from this point of the compass are unfavourable to the health of plants. They predispose, therefore, to blight; and hence the notion that east winds carry the disease.

When the elm trees in St. James's Park and the neighbourhood of London were observed to be dying, about twenty-five years ago, without any other apparent cause than that they were infested with a grub which groped its way under the bark, the Government appointed several scientific gentlemen to investigate the matter. They came to the conclusion that the unhealthy condition of the trees prepared a *nidus* for the insect, and that the real cause of the malady was the dense population, the consequent increase of coal fires and smoke, and deterioration of the air, by which it was rendered less fit for vegetable respiration. Whether the newly planted trees have become acclimatized I know not.

The aphides of the potato may similarly be regarded as the *result* of a diseased condition of the plant; and I have no fear that the health of new plants, raised from seed in a new colony, would be readily affected by them.

XIII.

On Docks—Dry, Wet, and Floating. By His Excellency SIR WILLIAM T. DENISON, F.R.S., F.G.S., &c. [*Read* 11*th July*, 1849.]

THINKING it desirable that the Papers of the Royal Society should not be merely a record of new facts or observations upon matters connected with the progress of the arts, but that they should also contain such of the results of the experience of the members as may be likely to prove of practical use to the community, I have embodied in the present paper some general observations on the subject of the construction of dry docks, which will serve as an introduction to the detailed drawings and descriptions of some floating docks with which I was furnished some years ago by some friends in America, and which I now present to the Royal Society.

The term dock may be considered as a generic term, embracing all enclosed spaces for the reception of shipping. I say *enclosed spaces*, for although an area similar to that now in process of construction on the new ground in the rear of the Franklin Wharf will practically have all the advantages of a dock, yet as it is open to the sea, and as the tide will flow in and out uninterruptedly, it will be properly termed a tidal basin.

Docks, then, are enclosed spaces for the reception of shipping; and it is usual to classify them under the two heads of wet and dry docks.

The first of these is generally a large area where ships are always kept afloat. The second is not in general larger than is necessary to receive one, or at most two vessels; and arrangements are made to allow all the water to be withdrawn from the dock, so as to leave the vessels dry to enable shipwrights to work upon them, and to execute all the necessary repairs.

The wet dock presents but few features of interest to the inhabitants of Hobart Town. Our harbour is, in fact, for all practical purposes, a large wet dock capable of containing any number of vessels. The rise and fall of the tide is too small to affect to any extent the arrangements which may be made on the wharf for the convenience of loading or discharging cargoes, and there is always depth of water sufficient alongside the wharf to float the largest vessels.

At Launceston, however, it may be desirable eventually to enclose an area in which vessels may always be kept afloat. The tide in the Tamar rises from 10 to 12 feet, and vessels alongside the wharf are aground at low water, and are liable, therefore, occasionally to receive some damage.

I propose, however, to limit myself at present to the subject of dry docks.

The object of these being to facilitate the repairs of vessels, it stands to reason that in a port which, like Hobart Town, is visited by upwards of 92,000 tons of shipping annually—where the vessels belonging to the port are increasing daily—where ship-building is carried to an extent seldom seen in a colony, and where the cheapness and quality of the materials used, and the comparative cheapness of labour, will, in all probability, lead to a still greater extension of this trade,—it would be advisable to offer every possible facility for the repair of the shipping trading in these seas.

Hundreds of vessels are employed in the trade of these colonies—hundreds of vessels belonging to different nations are employed in the whale fishery; and it is not too much to expect that, whenever any accident might render repair necessary, many of these vessels would resort to this port,—which is easy of access, where the climate is good, where provisions and stores are cheap,—could we offer to them the necessary facilities for the execution of the repairs of which they might stand in need.

As, therefore, the interests of the Colony are, I may say, to a certain extent bound up in this question, I have thought that a sketch of the different systems upon which dry docks have been constructed, together with an account of the difficulties attendant upon their construction in different localities, would not prove uninteresting, more especially as introductory to a more minute account of a plan which has been adopted in America, in a locality analogous, as far as regards the rise and fall of the tides, to the harbour at Hobart Town.

Dry docks, for the reception of ships while under repair, may be classed under two heads:—

1st. Those where the space for the dock is excavated out of the solid ground, and made secure by some means from the percolation of the water.

2nd. Those where the receptacle for the ships is itself afloat, being, in fact, a floating chamber, large enough to receive a vessel, with means and appliances for preventing the ingress of water, and of getting rid of it should any leakage take place.

There is also a third class, which, however, can hardly be called a dock, inasmuch as when the vessel is floated into its place, it is afterwards lifted bodily out of the water by means of some mechanical agents.

In considering the construction of those belonging to the first class, one of the first circumstances to be taken into consideration is the rise and fall of the tide, at the point where the dock is to be made. Should the rise of tide be great, (exceeding, in fact, the draught of water of the vessels for whose use the dock is intended), the difficulty of the construction and working of the dock is very much diminished —the foundation being above low water-mark, the whole of the work can be done without incurring the expense of constructing a coffer-dam to keep out the water. As the water ebbs below the floor of the dock, no provision need be made for pumping the water out of it, as it can be allowed to flow out at ebb tide.

Little or no difficulty will be experienced in keeping the apron in front of the entrance clear for the opening of the gates, as it will be exposed at every tide.

The construction, therefore, of a dock in a tidal river, when the rise of the tide exceeds say 20 feet, is the simplest operation of the kind; and I will proceed to give an account of the difficulties which are likely to be met with, and the precautions which must be taken, in order to secure the work as it proceeds.

The first matter to be looked to is the foundation of the proposed dock,—Is it solid enough to sustain the load which it will have to carry without the assistance of piles, or some other artificial support? If solid enough for that purpose, is it pervious to water? On the answer to these questions will depend, in great measure, the cost of the construction.

Should the foundation be, as is often the case in tidal rivers, a mere mud-bank, it will be necessary to provide a solid bearing for the floor of the dock and the side walls, by driving such a number of piles as may be necessary to sustain the whole weight of the dock and of the vessel which may be under repair in it. Upon the piles will the floor of the dock be laid. If the material of which it is constructed be stone or brick, a platform of timber will be required upon the top of the piles. Should the ground, however, be solid, it will be levelled to receive the floor of the dock, which can be built at once upon it.

Whether, however, the ground be hard or soft,—whether it be necessary to use piles or not, there is one most essential precaution to be taken in laying the floor; for want of proper attention to which many accidents and failures have taken place.

The floor, however constructed, should be able to resist the upward pressure of the water. At high water, when the dock is completed, the gates closed, and the docks empty, should there be any means by which the tidal water could make its way under the floor of the dock, a thing not unlikely to happen, there would then be an upward pressure equivalent in pounds weight to the area of the part thus acted upon by the water, multiplied by the height of the water outside above the floor, and this multiplied again by 62½ lbs., the weight of a cubic foot of water.

If we suppose the area of the floor to be $120 \times 30 = 3600$ feet, and the height of the water 20 feet, $3600 \times 20 \times 62\frac{1}{2} =$ 2009 tons.

Provision is made against this pressure when the floor is constructed of stone, by making it in the shape of an inverted arch, and taking particular care that the joints of the masonry are tight.

When the floor is of wood, the beams of which it is made should be near enough together and strong enough to withstand the pressure, and the planks spiked upon them should be carefully caulked.

The weight, too, of the walls should be calculated to withstand the maximum lift which might be exercised by the upward pressure of the water, as well as the pressure of the earth behind them.

The floor and the walls being constructed with all the arrangements which may be desirable, in order to facilitate the work of the shipwrights,—such as steps from bottom to top, slides for timber, altars or steps for the shoring timber to rest against,—the next thing to consider is the mode in which the entrance should be closed. This may be done in two ways,—either by gates, or by a caisson, which is a floating vessel made to fit into grooves in the sides and bottom of the dock entrance, and which can be floated into its place and then sunk so as effectually to close the opening.

The question as to which of the two plans is to be adopted turns upon a variety of considerations. When the opening of the dock is not very wide, and there are means of clearing the apron in front from any collection of mud or sand, gates would probably be the cheapest, and most certainly the easiest mode of closing the entrance; but when the opening is very wide, as in the case in docks which are required to admit steamers of a large class, and where there is the risk of collecting mud and sand to any great extent upon the aprons in front of the gate, which it would be difficult to remove on account of the depth of water over the sill at low water, then a caisson is the cheapest and most effectual mode of keeping out the water. There is an advantage attendant upon a caisson even where the water does ebb nearly away from the apron, inasmuch as it is possible to retain a head of water in the dock, and to let it out by means of sluices through the caisson,—thus creating a scour in front of the dock entrance, which may keep it clear of deposit.

When I stated that, under certain circumstances, gates would prove the cheapest and easiest mode of closing the entrance, I referred principally to those which, turning upon heel posts fitting in a groove in the piers of the dock, meet at an angle, and are supported against the pressure of the water,—partly by the sill against which each leaf rests at the bottom, and partly by each other: the angle at which the leaves of the gate meet render it impossible that they should yield to the water, unless the piers against which the pressure is thrown should give way, or the framing of the gate itself prove too weak. There is, however, a simple kind of gate, composed of three portions, two of which rest in grooves, or against projections in the sides of the piers and against a sill at the bottom; while the third fits in a sort of keystone between them. These are allowed to float away when not required, or to lie on the apron,—are hauled into their proper position by ropes,—and, when once fixed, have the additional support of shores against the piers, as shown in the sketch. This arrangement is cheap in its original construction; but it is clumsy, and requires a good number of hands to work it properly. The objection to the caisson is, that it requires a number of hands to work it, especially if the tide does not ebb sufficiently to allow of the water which sinks it into its place being drawn off, the labour of pumping water out of a caisson is very great.

These are the principal matters which have to be attended to when a dock has to be constructed in a river where the tide ebbs away below the level of the floor. The same difficulties will have to be surmounted by the engineer in constructing a dock where there is little or no rise of tide:

but, as in this case, the whole space intended to be occupied by the dock must be excavated to the necessary depth below the surface of the water in the river and harbour, he will, in addition, have to exercise every precaution to prevent the water of the river making its way into the excavation. A coffer dam, as it is called, must be constructed, steam-engines and pumps provided, to keep the work clear of water; and after every precaution has been taken it may be found that, owing to the porous nature of the soil, or other circumstances connected with its geological character, it may be impracticable to execute the work except by means of a diving bell,—and that at a cost altogether incommensurate with the object to be attained.

At Bermuda, the Ireland Island, where the Government dockyard is placed, is composed of a porous limestone, an aggregation of broken shells and coral sand, the whole being so pervious to water that an excavation at any point carried a foot or two below the level of the sea is filled with salt water in a very short time. By no means, then, but by the diving bell could either the necessary excavations be made, or the masonry of the floors and of the sides of the dock be constructed in such a situation.

A coffer dam is not merely an expensive undertaking, but it requires constant care and attention: it is generally made of two rows of sheet piling, about 5 feet apart—the interval is filled with clay puddle; care must be taken to connect the two rows of piles together by means of strong bolts to as great a depth as the water will allow,—the pressure against the piles by the weight of the clay and its tendency to expand by wet being very great. I have seen a pile, 12 inches square, broken short off by the pressure of about 20 feet of wet clay, the weight of which would not have exceeded 130 pounds to the foot: the effect, therefore, could not be attributed to the weight of the clay, but to the expansion caused by its absorption of water.

Great care must be taken to support the coffer dam against the pressure of the water by a proper system of shores; and this it may be imagined is not a matter of trifling importance, when it is considered that a head of 20 feet of water outside a coffer dam gives a pressure upon every foot of its length of 5½ tons; and this, if the bottom of the pile be considered as fixed, is acting with a leverage of 10 feet to turn it over.

It is usual to place the shores at a distance of about 10 feet apart, in a horizontal direction, and of from 6 or 8 to 4 feet apart in a vertical direction; and even when placed at such short distances, the strain thrown upon them is enormous, calling for every possible precaution and attention on the part of the engineer.

While the coffer dam is in course of construction, care must be taken that the water inside is never allowed to remain at a higher level than that outside, otherwise the whole fabric will be forced outwards. Sluices, therefore, must be provided, by which a free communication may be established between the interior and exterior.

When the coffer dam is completed and the ground prepared, the work will proceed in the same manner as before described. All the precautions which were required in the dock built in the tidal river will be required: indeed, greater care should be taken, because, should any accident happen, it can only be remedied by the adoption of expensive means of shutting out the water and pumping the dock dry; while, in the other case, the repairs can be executed at once.

Having now said all that is necessary upon the subject of the first kind of dock, I will proceed to give a short sketch of the modes in which the floating docks, or those lifting docks mentioned under the third head, are brought into operation, merely as an introduction to the descriptions of those American inventions, drawings of which I now lay before the Society.

The simplest kind of floating dock is a large box capable of containing the vessel requiring repair, with space sufficient to allow the shipwrights to work: into this the ship is floated, the gates are shut, and the water pumped out,—the whole gradually rising till the weight of the dock and the vessel in it is balanced.

It is necessary in this case that the dock should not be placed in deep water, and that it should have either a level bottom or a soft mud to ground upon, as when the water is admitted the whole will of course sink.

The next kind is one in which, in addition to the simple box, there are water-tight chambers sufficient to float the dock itself when the water is allowed to enter it: by admitting water into these chambers, or by pumping it out, the dock may be sunk or raised to the proper draft of water of any vessel which may require repair.

The third class, or those which may be more properly called lifting docks, will in principle include the hauling-up slip,—a contrivance by which vessels, when floated into a frame rolling upon trucks, are hauled up an inclined plane till they are beyond the reach of high tides: but I shall not enter into any of the details of this plan at present. Those to which the term lifting docks is more especially applied consist generally of a series of frames supported from piles, or piers by chains, which chains may be acted upon by various descriptions of mechanical force,—such as hydraulic rams, or steam engines working wheels, round which the chains are wound, &c.

The objections to the floating docks are the difficulties which are encountered in repairing them. Should any accident happen to the floor, the only mode by which it can be repaired is by hauling the dock upon *ways* laid on a sloping beach till the shipwrights can get at the floor; and this would involve a large expenditure of labour and material.

The saving, however, in the first cost of construction would amply repay any outlay of the kind; and the objection does not apply with so much force to the lifting dock, which can at all times be repaired with ease and expedition.

I will now proceed to describe, shortly, the sketches and drawings which I lay before the Society.

The first is a floating dock, invented by Mr. Gilbert:—it is constructed entirely of timber, appears very simple, and is capable, as far as its principle is concerned, of being extended to take in vessels of any size. The side chambers, or camels if they may be so called, serve to support the dock when the gate is opened, and the dock filled for the admission of the vessel: a steam engine and pumps will be necessary in order to pump the water from these chambers, and from the dock itself. Mr. Gilbert's own description will give all the necessary details of the construction and mode of operation of this dock.

The second set of drawings consist of five, which are explanatory of all the details of Messrs. Skull and Martin's floating dry dock, which is, in fact, a lifting dock, in which the vessel, after being floated on to a cradle, supported partly by air-tight chests or tanks, and partly by framing attached to the floor on which the cradle rests, is lifted by means of pinions working into racks upon this framing,—the moving power being a steam engine, which turns a set of working shafts connected with the pinions.

In the drawings a large turn-table is shown, the object of which is to enable the cradle, with the vessel upon it, to be removed from the dock and transferred upon a railway to any part of the yard connected with the dock, which might thus be used for the repair of several vessels.

The third set of drawings comprises three, which give the details of another lifting dock. In this, which is of a less elaborate construction than that of Messrs. Skull and

Martin's, the immediate moving power consists of two large hydraulic presses, the pumps of which are worked by a steam engine, and which act through the intervention of connecting rods and chains upon a series of trussed frames, upon which the vessel is supposed to rest.

In the plans of the two lifting docks a good deal of ingenuity has been displayed; and I have no doubt that, under certain circumstances, an adaptation of some methods of lifting a vessel clear of the water analogous to these may be advisable.

In the circumstances, however, in which this colony is placed, I should hesitate in advising an attempt to carry out an elaborate system, which would require the perfect adaptation of the different parts of the machinery to each other to ensure success.

I should very much prefer the simple construction shown in the first sketch of a floating dock, where no skill is required beyond what the talents of the ship-carpenter can supply, and where materials of the best quality in the timber of our forests can be cheaply and easily procured.

XIV.

On the Modes of Shipping Coal practised at various Ports in England. By His Excellency SIR W. T. DENISON, F.R.S., &c. &c. [*Read 12th September,* 1849.]

HAVING visited in the year 1846, by direction of the Lords Commissioners of the Admiralty, the following Coal Shipping Ports in the North of England, viz., Newcastle, and North and South Shields, on the Tyne; Sunderland, on the Wear;

and Stockton and Middleboro', on the Tees; and having carefully examined the various contrivances at each of these places for facilitating the shipment of coal,—the following extracts from a Report which I made to the Admiralty on that occasion may not be unacceptable to the Society :—

The machinery in use at these different ports may be classed under three heads :—

1st. That of spouts or shoots, which have been in use for a long time, and is the simplest. Here the coal is delivered into a sort of box, the bottom of which is inclined at such an angle as will just cause the coal to slide upon it. The lower end of this box or spout is closed by a sliding door. To this box, which is a fixture, being connected with the framing supporting the tramway upon which the coal waggons run, is attached a moveable shoot or spout, for the purpose of directing the fall of the coal when the sliding door is withdrawn to the proper point on board the vessels.

The fixed box is filled from above, the coal waggons being emptied into it through a trap in the road between the rails : it contains sometimes as much as 10 or 12 tons.

The objection made in the trade to these spouts is, that they break up the coal into small particles and dust : they are, in consequence, only used for shipping the small coal and slack.

2nd. That of lever drops, which is a plan in common use both in the Tyne and the Wear.

In this the waggon, as in the former case, runs upon a platform, supported at some distance above the level of the wharf. Double lines of rails, with *turn-tables*, from distance to distance are laid upon this platform, in order that the lines of empty and loaded waggons may not interfere with each other, and that the latter may be easily brought to the points from which they are to be discharged into the vessel. At these points a stage is made to project toward the river, and a long lever, composed of two arms, far enough apart to allow of a coal waggon passing between them, and yet strongly connected by cross bracing, turns upon a centre or axis near the level of the wharf, at the foot of the stage: from the end of the lever is suspended a stage, which, when the lever is raised, is on the same level as the projecting stage of the platform; and to allow the waggon to run upon it without any difficulty, rails are laid on it to correspond with those of the platform.

The lever is kept in contact with the projecting stage by a counterpoise, to which two flat ropes are attached; which, passing over a drum on a shaft above the upper platform, are connected with the cross bracing at the head of the lever. This counterpoise is heavy enough to counterbalance the empty waggon, lever, &c., but light enough to yield when the loaded waggon is on the platform.

A powerful *brake* is fixed upon a large wheel upon the shaft which carries the drums, or on one which gears with it; and by means of this brake the descent of the loaded waggon or the ascent of the empty one is regulated. The mode of action is as follows:—

The waggon is run off the line of rails parallel to the wharf by means of a turn-table, and is pushed on to the hanging-stage by two men, and then wedged in its place: one of these men now attends to the brake, while another stands on the hanging-stage and accompanies the waggon. As soon as the waggon is fairly fixed on the platform the brake is slackened, and the weight of coal in the waggon (amounting to 53 hundred weight, or a Newcastle chaldron), causes the lever to turn upon its axis and descend, carrying with it the stage, the waggon and the men, the counterpoise being regulated to prevent any accelerated motion.

As soon as the hanging-stage or platform carrying the waggon is near the level of the deck, the brake is tightened and the whole remains fixed; while the man who accompanies the waggon loosens a *catch* which fastens the bottom of the waggon, and the whole of the coal is at once discharged into the hold of the vessel.

As soon as the waggon is empty the brake is again slackened, and the counterpoise coming into action brings back the lever and the empty waggon into its original position, and the latter is then run off to the line of rail appropriated for the empty waggon. In some instances the levers are nearly 60 feet long, in order that the waggons may be carried far enough out to *plum* the hatch of a vessel at that distance from the shore, for they are frequently obliged to remain at some distance from the wharf line for want of water in the river to keep them afloat.

By means of this contrivance from 60 to 80 tons can be put on board a vessel in one hour; and it has this advantage over the spout, that the waggon can always be brought down within a foot or so of the deck of a ship, so that the coal has no greater distance to fall than from the deck to the hold,—and there is, therefore, much less risk of breakage.

There are several modifications of the principle upon which this drop is made; the difference consists principally in the arrangements of the counterpoise. In one of these modifications the lever has its centre of motion in the middle of its length, or thereabouts; while the counterpoise is a fixed weight at the end of the arm.

3rd. That of vertical drops. This plan coincides with the second, in so far as a counterpoise is used to bring back the empty waggons,—but it differs from it in that there is is no lever; the waggon is run out upon a platform supported by counterpoises, the motion of which is governed by a break-wheel. The platform and waggon descend together vertically,—one end of the platform working in two cast-iron guides, which are attached to the standards of the fixed stage or tramway. Provision is made by means of blocks and tackles for lifting the platform clear of the shrouds and rigging of the vessels when they are brought alongside of the wharf. This drop has of course no great amount of projection beyond the line of the wharf or front part of the fixed stage; it is principally in use at Middleboro', where there is a dock for the reception of the colliers, and where by means of this drop two men can load about 120 tons per hour.

These are the various systems now in use at the before-mentioned ports for shipping coal on board colliers, and by which an enormous amount of coal is shipped with very little delay or inconvenience. It is evident that, both in England and in this Colony, the charge for freight will form the largest item in the cost of coal; any arrangement, therefore, by which a vessel can be loaded rapidly will go to diminish this head of expense. The saving of a single day in loading a vessel on the east coast will be equivalent to a reduction of 8 or 9 per cent. at least in the freight,—throwing altogether out of consideration the diminution of risk to a vessel lying alongside a wharf in an exposed situation.

I have not given any sketches of the different kinds of machinery employed, not having brought out the drawings with me; but I have sent to England for them, and when they arrive I shall be happy to lay them before the Society. In the meantime I shall be willing to give any information which may be necessary to enable any competent person either to make a model of the machine, or such a drawing as may be sufficient to guide a contractor in forming an estimate of the cost.

XV.

On the Construction of the Bridge and Causeway across the River Derwent at Bridgewater, in Tasmania. By WM. PORDEN KAY, *Esq., Director of Public Works, &c.* [*Read 14th November,* 1849.]

THE bridge lately constructed for the purpose of connecting the end of the Bridgewater Causeway with the opposite or northern bank of the River Derwent forms part of the main line of road of communication between Hobart Town and Launceston. For several years the project of carrying a causeway and bridge across the river at this place had been a favourite one with the public; and in pursuance of that object the former work was commenced—and, indeed, nearly completed—by Colonel Arthur, when Lieutenant-Governor of this Colony.

With respect to the bridge itself, various plans had from time to time been proposed as being desirable to carry out; but much hesitation was shown to commence a work which, from the nature of the bed of the river, was, in the opinion of many, deemed to be one of much difficulty in execution, and some uncertainty in its accomplishment. The impediment also which, it was stated, would be caused to the navigation of the river by the erection of a bridge was another point of much importance, requiring consideration to be dealt with successfully.

These difficulties, however, have, I believe, been all satisfactorily met in the present work, which, although not laying claim to any architectural beauty of design, may be deemed a structure of high utility and advantage to the Colony, and likely to answer its purpose of public convenience for many years to come.

The bottom of the river across its whole width is composed of mud, varying from 5 to 15 feet deep, and under it is a bed of soft clay of unascertained thickness.

The depth of water in the channel, or deepest part of the river, is from 20 to 25 feet.

The rate of the current in the summer time, when the stream is lowest, is not more than from 1½ to 2 knots per hour; and in times of a flood it rarely exceeds 4 knots.

From the above data it will be seen that no difficulty was to be anticipated in driving piles of any required length: the points upon which any doubt existed were, whether they could be so driven and secured together as mutually to assist each other in rendering the whole structure stable, and made sufficiently secure for carrying the superstructure and for resisting the pressure of the current in times of flood,—for it had long been contended that piles, when driven into so soft a stratum as the river's bed, would not be found to be equal to the required purposes.

Consequently, the contractors bound themselves to drive piles which, at the last or trial strokes, should not be depressed at each stroke more than 1 inch. This condition, however, was not fulfilled, and, apparently, could not be—no pile being driven which did not exhibit at the last stroke a depression of 3 or 4 inches.

The piles, which were from 65 to 90 feet long, could therefore have been driven with ease much further into the bed of the river had their length permitted; and they were not so firmly fixed immediately after driving but that they could be readily made to move or shift in their places from side to side. But it was found, after the duration of a month or so, that they became much firmer and stiffer, the clay bed in which they were placed adhering closer to them,—it having in the first instance been disturbed by the process of driving. In nearly all instances the depth of driving was 40 feet, and in some as much as 50 feet.

The supports of the bridge consist of 20 piers 8 feet broad, composed of 12 piles each in a double row, 10 of which carry the platform and 2 are for the purposes of fender-piles—the intervals form 22 bays of 32 feet span each; of an abutment of 25 feet long on the southern end adjoining the causeway of 25 piles: and of a pier carrying the moving parts, or rolling bridge, of 100 feet long, consisting of 98 piles.

The total number of piles driven is 363. The roadway is borne on longitudinal beams, 5 in breadth, carried from end to end by the heading pieces secured on the piles, and strengthened by a system of strutting between the several bays or openings.

At the third bay, from the northern shore, which has been made 35 feet in the clear opening, the navigation of the river is secured by the adoption of a moveable platform, or rolling bridge, which is readily removed, whenever occasion requires, to allow a vessel to pass through. It opens in the following manner:—

On the pier provided for the purpose are fixed a series of large flange wheels carried on strong timber framing; upon these the moveable part of the bridge is run in or out, iron rails being fixed on the under side of the longitudinal beams, which traverse upon the wheels as they turn.

The space which is thus occupied by the rolling bridge, when run in, is filled up when it is run out, or across the opening, by platforms upon wheels working laterally on railways at each side, right and left. The breadth of the roadway through these moving parts is considerably narrowed, being only 12 feet, and admitting but of one vehicle to pass at a time.

The method adopted for moving this bridge is by powerful crab-winches, working in toothed rails fixed on the framing under the bridge. They are worked by men standing on the bridge, who move along with it.

The lateral platforms are also moved by crab-winches fixed on the framing below, and working moveable toothed racks, which draw the platforms apart.

The rolling bridge is formed by large timber trusses placed on either side, and further strengthened or stiffened by suspension chains from a centre tower, or framing, erected on the bridge for the purpose.

A double row of fender-piles is driven (in addition to those already described as belonging to the bridge) at this opening, extending up and down the stream for a distance of 175 feet, upon which is placed a stage, which answers the purpose of a towing path for vessels while passing through the opening. The present amount of traffic on the river by boats passing is very trifling. A steam-boat once a day, and two or three small craft which occasionally pass, are all the vessels which require the bridge to be opened. No inconvenience or hindrance is felt by the steam-boat in going through, her passage being quite uninterrupted.

It may not be out of place to mention that some piles, which were driven 18 or 20 years ago for the jetty of the ferry on the north shore, showed no symptoms of the ravages of the worm (*Teredo navalis*), which is generally so destructive to timber works constructed in salt water; there is, therefore, every reason to hope that the bridge may escape injury from such a cause.

The extreme length of the causeway across the mud flats on the southern shores of the river is 2350 feet, and it averages in breadth 70 feet.

The length of the bridge from the end of the causeway to the northern shore is 960 feet, with a breadth of roadway of 24 feet.

The height of the roadway above the highest high-water level is 9 feet, while the greatest variation in the level of the tide is about 5 feet.

The whole work extending to a length to 3310 feet, or nearly three-quarters of a mile, is, I believe, the largest ever attempted in the Australian Colonies; a work which could not have been accomplished in this Colony but for the abundance of labour at the disposal of the Government, and which has been made available throughout the works from their commencement. From the slight records that have been kept of the actual cost and duration of the works at the construction of the causeway I am only able to gather the following particulars:—

It was commenced in 1830, and finished in 1839, at an average expenditure of £4500 per annum.

The solid contents of the material of the causeway filled into the river cannot be computed at less than 560,000 cubic yards, which, for the quarrying, moving, and placing, have cost 1*s.* 5½*d.* per cubic yard.

The cost of the bridge, completed, has been £7580, which, added to the former amount, makes a total expenditure of £52,780.

XVI.

On the Export and Consumption of Wattle Bark, and the Process of Tanning, &c. By J. MITCHELL, Esq., D.A.C.G. [*Read* 12*th June,* 1850.]

THE gradual decline which the following Table exhibits in the exportation of mimosa bark would seem to evince either an exhaustion of the supply, want of remuneration in the trade, or apathy on the part of the Colonists towards what may be looked upon as one of the most genuine of all colonial products. It is gratifying, however, to know that abundance of this article remains; and that, although exportation has diminished, colonial consumption has increased,—while the export itself still offers a fair prospect of gain to those who will devote an ordinary share of attention to its preparation.

The Table is taken from the Returns of the Board of Trade, which will be found published in the Sydney Gazette when relating to colonial produce; and by it there appears to have been exported from New South Wales—in which, it is presumed, Van Diemen's Land is included—in the year

1845	1710 tons.
1846	956
1847	408
1848	201

and to the 30th November only in 1849, 238 tons; thus showing a decrease of about one-half in each succeeding year until the last, when improvement seems to commence.

The value of sound bark in Van Diemen's Land at present ranges from £2 to £3 10*s*., according to dryness, or the year's strip. Its last quoted price in England was from £10 to £11 15*s*. The freight and charges may be estimated at about £4 10*s*., thus leaving £3 or so as the profit per ton to the exporter. Bark is admitted into England duty free.

Sufficient care does not appear to be taken in drying it, for it is frequently found to be damaged, and buyers are, consequently, cautious in making their purchases.

There is, however, another form in which the mimosa bark may still yield remuneration to exporters, viz., as an extract. This was tried several years ago; but, like the export in its natural state, it fell off, and to a much greater extent. As much as £80, it is said, has been given in New South Wales for a ton made from nine tons of the bark; but imperfect preparation and, what is much worse, adulteration have so lessened it in estimation, that its price has dwindled to £20 in New South Wales, and it is, consequently, seldom if ever made now. But when we remember the enormous outlay and venture attending the acquisition of whale oil, it surely seems desirable to attempt the renewal of an export nearly equal in value, attended with comparatively little expenditure; for the cost of boiling pots and a few casks from one whale ship would furnish the greater part of the material of an extract manufactory.

The bark to form extract is ground, macerated for 48 hours, and the infusion evaporated by boiling to the required strength.

It may be mentioned that an objection has been taken to our bark, which tells in price, though there is no real deterioration in quality,—it is said to turn the leather red, while the oak bark gives it a pale buff; but as colour is of no great importance in leather, it is unfortunate that we should suffer by what may be called a mere fancy of the trade.

There is inducement to redeem the character of the extract in the estimation of our shippers and manufacturers, as it is likely to be much more extensively used than heretofore. The article on tanning in the Penny Cyclopœdia contains a notice of at least one successful attempt to shorten the process by the use of extract; and it cannot be believed that this time-saving age will long submit to the tedious method hitherto followed, when it is known that hides have been tanned in a few hours; while from six months to two years is taken in the usual way.

The principle is now well understood by the intelligent tanner; yet, though every one knows that bark is used in tanning, few ordinary persons are so fully aware of the manner in which the transmutation takes place in the hide but that a brief explanation may render the subject more clear to them.

There is a chemical affinity, or attraction of combination, between tannin or the astringent principle of bark and all kinds of gelatin. This may be shown by pouring a small quantity of the extract into a solution of glue or other gelatinous substance; the two (the tannin and glue) combine and form a compound, leaving the water which held them in solution free.

The skins of animals being composed of gelatin attract the tannin from the bark, or rather its infusion, when they are placed together in the pits; but as the structure of the skins is extremely complicated and minutely cellular, the tannin is required to penetrate each cell, and combine with its sides, or fill it, before the skins are completely tanned. A single infusion will not carry a sufficiency of the tanning principle to effect this, and hence arises the tediousness of the process; for the water of the first infusion, after penetrating the cells and depositing its tannin, must be displaced by another and stronger infusion. As the outside cells also are the first to attract the tannin, they consequently form a barrier to the inner ones, which complete and long saturation alone overcomes. If a hide be taken from the pit before it is completely tanned and cut through, a white streak in the centre will mark the line of cells beyond which the tannin has failed to penetrate.

The great desideratum, therefore, is, a means of forcing a continuous stream of extract through the hide without destroying or injuring the texture. A variety of plans have been tried to effect this,—some with partial success, others with complete failure; a few will be found mentioned in the article already alluded to, and by the saving of time effected with some of them considerable profits have been made: but there is generally some defect,—the hide is either too much stretched, imperfectly tanned at the edges, or marked by the apparatus used. The rolling between cylinders after emersion seems, however, to have obviated all these; and no doubt this discovery will be improved upon.

It was thought that by placing hides in a strong chamber from which the air could be exhausted, and sudden injections of extract made, that the water might be drawn from the hides in this way after each injection, and the process repeated any number of times required; but if this plan were tried, capillary attraction alone would prevent its success. Many have succeded in tanning a single hide quickly; but any invention, to be of value, must be capable of being applied to hundreds at a time before it can compete with the present mode,—by which, in some of the large tanneries, thousands are turned from the pits at once.

It is singular that an art known from the earliest ages should have remained until the present day without any material improvement. Were Simon, the tanner, to appear among us he would find his craft much as he left it; but even he may be looked upon as a modern comparatively, for remains of leathern articles are found in the oldest ruins of Egypt and Assyria: indeed, the art may have been practised long ere human records existed, and seems to have immediately followed the earliest use of skins by the first of the human race.

XVII.

On a Specimen of Pristis cirrhatus, *by* J. E. BICHENO, Esq., F.R.S., &c. [*Read* 12*th June,* 1850.]

New Town, 8th June, 1850.

DEAR SIR,—Last week an old fisherman brought me a fine specimen of a saw-fish, caught in the Derwent. It turned out to be the *Pristis cirrhatus,*—a rare and curious species, confined to the Australian seas, and first described by Dr. Latham in the year 1793, in the 2nd volume of the Linnæan Transactions, page 281, plates 26 and 27, with this specific character — *Pristis rostro cirrato spinis longioribus ; brevioribus intermediis.—Habitat in Novâ Hollandiâ—In hac specie,* he says, *rostrum spinis circiter* 20 *acutis, modicè incurvis, muritum ; brevioribus* 3—6 *interjectis ad latera subtus utrinque cirrus elongatus flexilis.*

The subject from which Latham described was a male fish, having a total length of about 40 inches.

The fish brought to me was a female, and measured full 5 feet from the extremity of the snout to the end of the tail. The larger of the spines, set along each side of its snout, were strong, bony, trenchant, and pointed; the smaller intermediate spines varied in number from one to three in each space, and wherever the number was three the middle one was the longest and stoutest: but there was no regularity in the number. Besides these there was underneath a series of minute spines in a partially developed state, projecting at right angles with the line of the former series standing singly, pointing slightly backwards, each being a little in advance of the larger spines along the edges. The larger spines were stiff and straight, without flexibility in their sockets; the smaller yielded slightly to the pressure of the finger in the backward direction. About the middle of the snout, from orifices on the under side, sprung two *Cirrhi*, like those of the sturgeon, about 3 or 4 inches in length, fleshy, pliant, and about the size of large whipcord.

The skin of the female *Pristis* resembled that of the dog-fish in colour and texture. The reproductive organs were in a favourable state for examination; for there was found in her two young ones,—the largest 8 inches and the smallest 6 inches in length,—together with 12 eggs, the largest being about the size of a pullet's egg,—a tolerable proof of the species being ovo-viviparous. The young ones appeared nearly ready for extrusion. The story of the young of some congenerous fishes taking refuge inside the mother is a fable.

The spines on the snouts of these young ones, although standing at right angles with the edges, are easily laid back close along the sides of this weapon, so as to offer no resistance to its passage through any channel where the head would pass.

The superior advancement of one of the two young ones, and the gradations in the eggs (which had all the appearance of having been impregnated), were very consistent with the notion of the whole brood being a series, the completion of whose gestation would be acomplished at intervals, as in the case of birds. It has been observed that in the highest cartilaginous fishes, of which this is one, there is in their mode of reproduction an approach toward the type of this process in the superior *Vertebrata;* and that the fertilization of the ova, whilst yet within the ovary, takes place by actual congress of the sexes. The condition of the ova and of the young in this case seems to warrant such a conclusion. I have to express my regret that the opportunity of making the examination with reference to this important point, which the specimen would have afforded, did not fall into the hands of some more experienced physiologist.

I have the honour to be,
Yours faithfully and truly,
J. E. BICHENO.

JOSEPH MILLIGAN, *Esq.*,
Sec. Roy. Soc. V. D. Land.

XVIII.

On Timber Trees of New Zealand. By Capt. COLLINSON, R. E., *with Notes by* WM. SWAINSON, *Esq.*, F.R.S., &c. [*Read* 10*th July*, 1850.]

1. *Totara.*—(New Zealand Yew, *Podocarpus Totara*). This is a soft close-grained wood of a red-brown colour, with shades of yellow occasionally, something like a light cedar; has a short fibre, and breaks easily; dries light,

and shrinks a good deal both laterally and endwise. It is almost the only wood used by the natives for the palisading of their pahs, and for their canoes, on account of its durability. I have seen stakes of an old pah, which had been by all accounts about twenty years in the ground, and they were sound. When worm-eaten it is said to be most durable. It is difficult to paint, on account of a greasy matter in it, which is probably the cause of its durability. It is not useful in carpentry, on account of its want of strength, except for sleepers and boards; but it is useful in joinery on account of its easy working. *Totara* splits easily into shingles and laths.

It grows all over New Zealand, both on flat and hilly ground, but is more luxuriant on moist flats. It averages about 3 feet in diameter and 70 feet in height. It is not so plentiful as white pine, except in particular localities. Logs of it have been found 5000 feet above the sea lying on the ground, and also below the level of high water buried 6 feet in the clay. Its leaf is small, narrow and pointed, about ½-inch long and ⅛-inch broad. The tree grows to a bush at the top: it bears a small orange berry with a black seed on the top of it and ripens in June,—the bark splits off in large flakes. The specimen was got from a large tree in the flat valley of the Hutt, probably about 200 feet above the sea, and was cut in October, 1849.

(*Note by W. Swainson, Esq., F.R.S., &c.*—The *Totara* is the most valuable wood in New Zealand for building, fencing, and furniture; for it is not affected by wet, which rather preserves than injures it. I have seen large trunks that have remained buried in swamps for perhaps two centuries as sound and entire as ever. I believe there are three species: the red-wooded sort is superseded in the barren clay districts by one with a pale yellow wood; and a third is found on the hills, high up the Hutt Valley, which assumes a conic form, is seldom more than 30 feet in height, and not more than 1½ feet through.)

2. *Rimu,* or *Red Pine.*—(Order *Coniferæ, Dacrydium cupressinum).* Is a pine of a red-brown colour, with dark-brown veins; it has a long fibre, and frequently contains resin, but does not burn well. Polishes something like a coarse mahogany; it shrinks laterally in drying. The heart of it is a durable wood. From its strength and quantity it is more used in carpentry than any other wood in the south part of New Zealand, and is good for all descriptions of carpenter's and joiner's work.

It grows, I believe, all over New Zealand, but chiefly south of latitude 39°, replacing the Kauri, which stops about that latitude. It is found both on flat and hilly ground, but most luxuriant on the hills.

It averages 3 feet in diameter and 80 feet in height, growing to a peak with pendulous leaves. On level spaces among the hills there are groves composed almost entirely of small *Rimu* trees, very suitable for spars, being about 2 feet in diameter and 50 feet in height.

It is about as plentiful as white pine. The leaves are something like spruce fir, and hang downwards. The bark is in dark rough flakes. The fruit is a red berry with a black seed on the top, ripe in May.

The specimen was taken from a large tree at Karori, 3 miles from Wellington,—a hilly district, about 600 feet above the sea. It was cut in October, 1849.

(*Note by W. S.*—There is, I consider, a second species, which I have called the weeping pine, *Dacrydium pendulum.* The common *Rimu,* as well as the weeping species, is almost exclusively confined to poor stony or clay soils, which are unfit for agricultural purposes; for not one is found in the rich alluvial lands of the Hutt valley.)

3. *Kahikatea*, or White Pine (*Dacrydium excelsum*).—A pine of a clean white colour, and long close grain; dries light, and shrinks laterally. It does not last more than three years in the ground.

From its quantity, and easy working, it is much used for inside carpentry and common work; and, from its clean white appearance, is very good for interior work.

It grows, I believe, all over New Zealand, like the red pine, but chiefly in the southern parts. It is found both on flat and hilly districts, but most luxuriant on flat wet ground. It grows in thick groves of long thin clean trees, averaging about 2 feet diameter and 70 feet high, growing to a peak at top; the leaves are like spiked leaflets on soft stems, growing thick and pointing upwards; bark round and in smooth flakes, and dark coloured; fruit a red berry with a black seed on top, ripe in June. The specimen was taken from a large tree in the Hutt, and was cut in October, 1849. There is about half the quantity of white pine that there is of black birch in the south part of New Zealand.

(*Note by W. S.*—I have never seen the true *Dacrydium excelsum* on the hills rising from the Hutt valley, although on the flat alluvial soil of that valley itself it grows to a great size. In this locality it takes the place of the *Rimu*, which is strictly confined to the hills, so that the two species are only found together where the stony poor soil blends with the rich alluvial mould of the valley itself. It was with *Totara*, the commonest tree in the Hutt valley; but both are rapidly disappearing.)

4. *Tawai*, or black birch, is the most plentiful of any wood in the south part of New Zealand. It is of a light brown colour, with light veins, and a tough, close, and knotty grain. It is used frequently for ship-building, both for timbers and planks, and is said to last well; but it has

not been used much for carpentry, owing, I think, to its being more difficult to procure, and harder to saw and work up, than the pines. *Tawai* splits easily into shingles and laths.

It grows chiefly in mountain districts, and invariably in the poorest clay soils, where none of the other forest trees of the alluvial grounds are found. It is a mark of hard clay or gravelly soil. The rich flat grounds are covered with pines and other trees, whilst on the surrounding hills are forests of nothing but black and white birch, extending for miles ; and these forests are almost bare of underwood, which in the pine forests of the richer ground is remarkably thick. It grows like the English beech, and the leaf is something like the leaf of the beech. The bark is black and rough.

The specimen was cut from an average tree from the hills on the east side of the Hutt. The average diameter is about 18 inches, and height 50 feet.

(*Note by W. S.*—There are two distinct species in the Upper Hutt, the black and the white birch, known by the colour of their bark and the different shape of their leaves. A third is found on the mountains, and its lower branches hang on the ground. I have only seen this remarkable kind in the mountain glens of the Wai-nui-ornata.)

5. *Tana* (*Laurus Tana*) is not used in carpentry. It has a light coarse grain, with dark streaks. It burns well.

It grows almost exclusively on the flat alluvial grounds, being a mark of rich soil. It bears a leaf something like that of the willow, and grows like the ash. The fruit is a dark plum with a turpentine flavour, ripe in June.

The specimen was taken from a small tree in the Hutt, and cut in October, 1849.

(I have seen this tree in the Upper Hutt valley grow to an immense size.—*W. S.*)

6. *Rata* (*Metrosideros robusta*) is much used in shipbuilding for timbers, and by wheelwrights, on account of its toughness and crooked form. It is a dark red wood, like coarse mahogany, strong and tough. It grows chiefly on hills, and is a parasite. The stems grow up other trees, and, gradually uniting, replace the original, and grow to a great size, with ribbed trunks and crooked branches. It is therefore difficult to get a plank out of it. The leaf is like the myrtle leaf; it bears a crimson flower in December. The average size is about 3½ feet, and 50 feet high. The specimen was taken from a 2½-feet tree, at Karori, and cut in October, 1849.

(*Note by W. S.*—This is the most gigantic tree of this part of New Zealand. It is not always a parasite, as I often saw very large individuals with solid stems. Like the *Totara*, it resists wet, and ignites rapidly.)

7. *Kohai* (yellow).—A small tree; the wood brown, close-grained, and very tough and hard. It is used for cogs, and would, I think, be useful for all the purposes for which *Lignum vitæ* is used.

It grows near the water, in sandy soils, and among rocks, and bears a little round leaflet.

Specimen taken from the Hutt; cut in October, 1849.

8. *Matai*, or *Mai*.—A yellow pine, with a smooth clean grain, and a uniform colour—very good for all joiner's work, from its hard texture, and easy and fine working, and from its not shrinking in drying, being almost the only wood in New Zealand that does not. It polishes well to a dark yellow, is as durable as *Totara*, containing the same greasy matter, which makes it difficult to paint. It is much used for joiner's work, but not for carpenter's work, on account of its brittle grain.

It grows best on the hills, but is also found on the flats. It averages 2 feet in diameter and 50 feet high; bark like that of the *Kahiketea;* leaf like that of *Totara*, but smaller; bears a black berry with a stone inside, ripe in May; is as plentiful as *Totara*, but more expensive, being harder.

Specimen from Karori; average tree, cut in October, 1849.

9. *Mairi.*—There are two kinds, the black and the white. The black *Mairi* is a dark-grained wood, very strong and hard. It is used for strong framework; is very durable; but not being plentiful, and being very hard to cut, it is not much used. It grows only on hills, and poor stony soils. The leaf is about 2 inches by ⅛-inch, dark olive colour, growing in pairs. Bark rough, average size 18 inches and 40 feet high. Specimen cut at Karori in October, 1849.

White Mairi is of a lighter colour, with dark veins. The wood is like ash, and is used for the same purposes, but it is not plentiful. It grows on hills like the last; it bears a large red berry in winter. Leaf long and oval like a laurel, bark light colour and rough. Specimen from Karori; cut in October, 1849.

10. *Rewa-rewa*, or Honeysuckle, *(Knightia excelsa)*, not used in carpentry or joinery, but frequently in fencing, because it splits easily. The wood has a coarse grain, in red and white veins, with cross red veins, giving it a mottled appearance. It grows on the hills, but is not plentiful; has a smooth round bark, with lumps projecting, and a long serrated leaf; seed ripe in November; average about 18 inches and 40 feet high. Specimen from Karori; cut in October, 1849.

(*Note by W. S.*—This is one of the few trees that grows both on poor and rich soils. In the latter it reaches a very superior size, and is at once known in the forest by its close conical manner of growing.)

12. *Miro* (a pine) is a wood something like elm, of a red-yellow colour, short-grained, hard, knotty and durable; not being plentiful, it is not much used.

It grows on hills. The bark is like that of *Kahikatea*, but smoother; the leaves like those of *Totara*, but larger, and grow in regular pairs on the stem. Bears a small red fruit with stone inside, ripe in May. Averages the same size as *Mai*. Specimen from Karori; cut in October, 1849.

13. *Pukatea* is a common tree, both on hilly and flat country, but is not used for carpenter's or joiner's work, having a coarse grain and no strength, and being liable to decay. It is the worst burning wood we have. The leaf is something like that of the *Rata*, but serrated. Specimen from Karori; cut in October, 1849.

(*Note by W. S.*—This is one of the most gigantic trees in the Hutt forest, inferior only to the *Rata*. In the upper valley it is very rare, but in the lower it forms nearly three-fourths of the forest. On the hills it is rare and very small.)

14. *Hinau*—Is a light-coloured wood, something like oak, is supple and tough, and is used for cart-wheels and shafts, and for ships' timbers, but not extensively, being not plentiful, and generally of small size.

It grows chiefly on poor flat lands, or on hilly grounds. The bark is very rough, the leaves are oval and olive-coloured. The sap is used by the natives to make a blue-black dye, and the bark is used in Wellington for tanning; average 18 inches and 20 feet high. Specimen from Karori; cut in October, 1849.

15. *Titoke*, sometimes called by the natives *Topetope*, a light-coloured wood, with a tough and twisted grain, and knotty. It is the wood generally used by wheelwrights in the south part of New Zealand, and is also used for

ships' timbers. It is plentiful on the hills, but difficult to get at.

It is a small tree. The leaf has something the appearance of the oak leaf, being of the same size and colour, and serrated.

(*Note by W. S.*—I have only seen this tree in the alluvial lands of the Hutt valley, where it grows to the thickness of a man's body, but often to twice the size. It is almost superior to the *Rata* in hardness, and generally breaks the axe of the woodman. If left to expand, the stem is very straight, and it is then a beautiful tree.)

16. *Whawako*, common in the low swampy parts of the Hutt forest, where it is much esteemed for fencing, as its split is straight and easy. Its leaf very much resembles that of the olive and the *Tana*.—(Not having seen its flower or seed, I know not its botanical character.—*W. S.*)

17. *Manuka, or Tea Tree.*—This is a very hard dark-coloured wood, used for sheaves of blocks and such purposes; it is common all over New Zealand, and grows either on sandy or hard clay soils; but being generally small, and hard to cut, is very little used, except for firewood and axe-handles. It is a common wood among the natives for spears and paddles. A small species of it covers the ground like privet; the larger species resemble the Scotch fir. The leaf is very small and lanceolate. It bears a little white flower like a small white thorn flower, and is very fragrant when in blossom. It burns very well. The average size is 12 inches and 20 feet high. Specimen from Karori; cut in January, 1850.

(*Note by W. S.*—This name is indiscriminately applied to all the specimens of *Leptospermum*, of which I have discovered six in the vicinity of Port Nicholson; some are very small, whilst others grow to 40 feet high or more. Other species are peculiar to Australia, where it is also called the tea tree. I find it recorded that a tree of *Leptospermum lanigerum*, of Tasmania, (not found in New Zealand, I believe), has been measured 70 feet high by 7 in circumference. This is the broad-leafed swamp tea-tree of the colonists.)

18. *Kauri.*—This specimen was obtained from the north of New Zealand. The tree does not grow in the south.

T. B. COLLINSON, *Capt. R.E.*

Wellington, New Zealand,
February, 1850.

Note.

Hobart Town, March 26, 1850.

I herewith forward to you specimens of the principal forest trees that grow in the southern parts of New Zealand, and a short account of each, to which William Swainson, Esq., F.R.S., of the Hutt Valley, Wellington, has had the kindness to add the botanical names and some notes of his own. I also send specimens of the leaves of most of the trees.

Specimens of each have been placed in a palisade now making round the Soldiers' Barracks at Wellington, for the purpose of testing their durability. Specimens of each will be placed in the Museum of the Royal Sappers and Miners, at Woolwich.

In case any experiments upon the strength of these timbers should be made by the Society, I shall be much obliged to you to forward some account of them to the Commanding Royal Engineer, Auckland, New Zealand, who will be happy to supply you with specimens of the northern trees.

I must inform you that amongst the northern trees is the *Kauri*, the most important tree of New Zealand, and the *Puriri*, called the oak of New Zealand, neither of which is included in the list herewith enclosed.—I am, Sir, your obedient servant,

T. B. Collinson, *Capt. R.E.*

The Sec. Roy. Soc. V. D. Land.

XIX.

On Laap, or Lerp, the Cup-like Coverings of Psyllidæ *found on the Leaves of certain* Eucalypti. *By* THOMAS DOBSON, *Esq., B.A., of the High School, Hobart Town.*

[*Read* 11*th September*, 1850.]

THE white saccharine substance called "lerp," by the Aborigines, in the north-western parts of Australia Felix, and which has attracted the attention of chemists, under the impression that it is a new species of manna, originates with an insect of the tribe of *Psyllidæ,* and order *Hemiptera.*

According to Latreille, (*Dict. Classique d' Hist. Nat.* art. *Psylla*), only six species of this genus are known, and these are all proper to Europe.

The three species described in this paper are, in all probability, new to entomologists.

The larvæ of several insects avail themselves of their peculiar secretions to form a rude tent-like protection from their enemies and the weather. Those of the *Crioceres* are concealed under an irregular mass, having the appearance of macerated leaves. The *Cassidæ, Coccidæ,* and *Psyllidæ* are hidden under a cloak of white cottony filaments flowing from the articulations of the body. The *Psylla Eucalypti* enjoys a more profuse supply of glutinous pabulum than its European congeners, and is thus enabled to construct a more artificial and effective dwelling. It is, perhaps, owing to the remarkable dryness and mildness of the winter just past that these insects have been obtainable in their various phases of transformation at all times during the last four months. The white conical tents of the larvæ and pupæ may be readily detected on the leaves of the lower branches of the stunted gum-bushes in the Government Domain here; the groups of minute ova are not so obvious, and the perfect insect is seldom seen abroad. It is more often met with in a quiescent state, after it has cast off its pupa skin, and while its wings are yet moist and shrivelled up. Its existence in the present state is either very ephemeral, or it escapes observation by its incessant restlessness, and the peculiar faculty of leaping, to which it owes its generic name.

To the unaided eye the eggs appear like small yellow granules scattered in groups on either side of the leaf, and unprotected by covering. (Fig. 1, plate xviii.)

Under the microscope they are seen to consist of a translucent pyriform membrane inserted into the leaf by a pedicle, and containing an amber-coloured fluid of somewhat darker hue near the neck or fixed extremity. Just before the exclusion of the larva, the egg bursts longitudinally from its free extremity. The body of the larva is nearly transparent, except the eyes and dorsal vessel, and resembles in form that of the subsequent pupa. An early stage of the pupa's growth is shown in fig. 2. A thick uniform cylindrical thread of a transparent viscous fluid issues from the anal aperture, and terminates in a considerable globule.

Finer filaments proceed from between the rings of the abdomen, near the extremity of which are two principal excretory glands. At almost every articulation of the body and limbs the microscope reveals minute globules of this white fluid.

Four lateral tubular cases contain the rudimentary elytra and wings.

Fig. 2 also exhibits the first framework of the conical roof. Portions of the strong central thread have been turned up the back by the bifurcated tail, one extremity of each portion rests on the leaf, the others meet together and form a rough apex to the frame-work over the back of the insect. By turning round its body the finer filaments are passed from rafter to rafter in the inside, until they form an open basket-like covering, and combine into one thin glutinous cup-like sheet. The subsequently secreted fluid oozes out in drops at the base, and hardens and elevates the original roof on the wall formed by these accretions. This occasions the appearance of superposition, and the lateral displacement of the apex observed in most of the specimens of old lerp. (Fig. 3 a.)

When the pupa is about to undergo its final transformation, it escapes from its skin through a fissure down the back, eats its way out of the cone through a round hole, and leaves the skin within.

But when the base is not too firmly attached to the leaf, the pupa creeps out from beneath, and throws off its skin on the leaf. The perfect insect is represented in fig. 4. The antennæ are filiform, and have ten articulations. The two first are much shorter and thicker than the others, and the last is terminated by two hairs. Two elongated parallel tubes compose the "sucker," as it is improperly called, with which the insect pierces the leaf, and procures its juices. The eyes are prominent, globular, and compound. Immediately behind each eye is an *ocellus*. In many individuals a third ocellus appears in the central furrow which divides the head longitudinally, and therein they agree with the general character of the genus according to Latreille, Milne Edwards, &c.; but in others, as in fig. 4, this central ocellus is replaced by two ocelli separated by the furrow. This duality of organ accords well with analogy, and disposes me to believe that what has been hitherto considered a third central ocellus is really a combination of two minute ocelli, whose proximity and oblique position render them incapable of separation by our microscopes.

The wings are much longer than the body, and nearly colourless. The elytra are longer than the wings, almost of the same consistence, and deflexed. The abdomen is of a rich emerald green, and is terminated by two pointed projecting pieces, which play an important part in depositing the eggs and constructing the roof. The feet are furnished with two hooks, and a small membranous bladder. These vesicular appendages, as well as the antennæ, are continually in motion. The insect seems to prefer locomotion by running and leaping to that by flight. The male is somewhat smaller than the female, but presents no prominent difference in other respects. The description given by Dr. Anderson in the Edinburgh New Philosophical Journal for July, 1849, of the form and structure of the small white cones, is sufficiently minute and accurate. The tuft of hairs seen on most specimens consists of portions of the thick central thread which have failed to retain their hold on the surface of the leaf. If Dr. Anderson is correct in stating that the saccharine taste of lerp is confined entirely to these external hairs, there must exist a remarkable difference between the usual excrementitious matter of which these hairs are composed, and that secreted and expelled from between the abdominal rings, &c. In insects which subsist on vegetable juices, the salivary vessels are developed in an extraordinary degree; and whether the fine silky filaments exude from the salivary glands, as in the caterpillar, or are elaborated by a special secretory apparatus, it is quite conceivable that their nature may be very different from that of the excrementitious matter which has been subjected to the action of the various organs composing the intestinal canal. The ants are extremely fond of lerp; and the beautifully marked spider whose dwelling is a gum-leaf folded and laced together by white threads, has generally one or two tenanted cones and a large ball of fluid lerp within its abode.

I have recently met with another species of *Psylla* located on the red-curled leaves at the extremities of fresh young shoots, and protected by a different kind of lerp. The edges of the leaf are turned over so as nearly to meet; and within each of the two grooves thus formed is a series of white opaque shells of an elongated oval shape. (Fig. 3 b.) They are of a waxy consistence, and tasteless. The lower part is a thin film adhering to the surface of the leaf; the upper is much thicker, and covers the insect enclosed as in a bivalve shell. Overlapping each other like the scales of a fish, the upper valves form two rows down the sides of the leaf. The perfect insect (Fig. 3, nat. size) is about one-half larger than the cone-forming *Psylla*, the head and prothorax are of a bright yellow, the remaining segments of the thorax are dark brown, the abdomen a yellow green, and the elytra yellow, with two elongated dark brown spots at each tip.

When my attention was first directed to this subject, more than four months ago, I found, besides the common white lerp and its occupant, a larger and differently coloured lerp, with its peculiar *Psylla*, surpassing in beauty and structural development the species already described. The eggs of this third species are of a deep black-red colour, sometimes disposed in groups, sometimes isolated, and occasionally on the same leaf as those of the first kind. The colour of the larva is a reddish brown. The first shell-like coverings are little transparent, and in many parts quite opaque and dark brown. Its form is remarkably like to that of one valve of a cockle-shell. (Fig. 5.) The apex or hinge is always well attached to the leaf. As the insect grows, the digestive or secretory functions seem to be more perfectly performed, and the material of the covering become of a rich canary-yellow colour, and very translucent. The shell of yellow lerp varies in diameter from one-third to one-half of an inch. (Fig. 3 c.)

The strong threads all rise from near the point of attachment, which is at the cleft of the heart-shaped base, and arching over meet the leaf.

Around this fixed point the leaf is always more or less dried up and discoloured. A thick tuft of curling hairs rises from the neighbourhood of the apex. The finer striæ, which are disposed parallel to the surface of the leaf, and line the roof, are quite distinct and separate from each other. Around the base is a broad flat band of an open reticulated texture. A white filmy carpet, composed of extremely fine threads crossing in all directions, completes the interior of this beautiful structure. The pupa and perfect insect are twice as large as those which fabricate the white lerp.

The head and thorax are more highly coloured, and the abdomen of a warmer green. (Fig. 6.)

The elytra and wings are diaphanous, but the wing-cases of the pupa, and the elegant symmetrical nervures of the elytra of the perfect insect, are of a bright scarlet colour.

[Under each of these limpet-like coverings there is usually found one or two little drops of a thickish, nearly transparent, and sweet fluid, like honey, deposited there no doubt by the insect after enclosing itself, to become a resource probably in case of protracted imprisonment from any unfavourable state of the season as to temperature, humidity, &c. The insect would appear to be very susceptible to changes of temperature, and perhaps to atmospheric influences generally ; for I have observed that, when a twig having leaves, with the white cones plentifully scattered over them, is brought in and kept for a few hours in a warm apartment, the perfect insects disengage themselves and are seen to flit about in numbers.—J.M.]

ON A NEW SPECIES OF MANNA FROM NEW SOUTH WALES.

BY THOMAS ANDERSON, M.D. F.R.S.E.

(From the *Edinburgh New Philosophical Journal* for July, 1849.)

THE saccharine exudations of plants which have been classed under the generic term of Mannas, present, in all instances, a close resemblance in their chemical constitution. Their principal constituents are, gum, sugar, and the peculiar principle called mannite, which derives its name from its source, and has been considered as the characteristic constituent of a manna. All the varieties of manna obtained from European or Asiatic plants which have been examined contain this substance in greater or less abundance; and it appears also to be a common constituent of the fluid exudation of the leaves known by the name of Honey-dew. At least, this is certainly the case under certain circumstances, as it was observed by Langlois* in the honey-dew of the lime, which, during the hot summer of 1842, occurred in such abundance in the neighbourhood of Strasburg, that it fell from the trees in the form of small rain.

About 30 years since, a species of manna was brought to this country from New South Wales, which was obtained from the *Eucalyptus mannifera*, and differed in many of its properties from the European mannas. This substance was examined by Dr. Thomas Thomson†, who ascertained it to contain a species of sugar resembling, and yet different from, mannite. It was afterwards examined by Professor Johnston‡ who confirmed Dr. Thomson's observation, and by analysis obtained for this new species of sugar the formula $C_{12} H_{14} O_{14}$, which removes it altogether from mannite, and brings it into the class of the true sugars, containing hydrogen and oxygen in the proportion to form water, and further establishes its isomerism with grape-sugar, from which, however, it manifestly differs in all its properties. This was the first manna examined which contained no mannite; and I have now to add to the list another, similar in this respect, but differing in every other, and peculiarly remarkable from its possessing a regularly organised structure.

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* Journal für Practische Chimie, vol. xxix., p. 444.

† Organic Chemistry, Vegetables, p. 642.

‡ Journal für Practische Chimie, vol. xxix., p. 485.

The specimen subjected to analysis I owe to the kindness of Mr. Sheriff Cay, by whose son, Mr. Robert Cay, the substance was originally discovered in the interior of Australia Felix, to the north and north-west of Melbourne. An immense tract of country in this district is entirely occupied by a "scrub," as it is called in Colonial language, consisting of the mallee plant, *Eucalyptus dumosa,* the leaves of which at certain seasons become covered with this species of manna, which is known to the natives by the name of Lerp, the *l* being pronounced like the Italian *gl.* This substance was first observed by Mr. Cay in the latter part of the year 1844, when he explored a considerable district lying between lat. 36° 20' and 37° 10' S., and long. 142° 40' and 144° 20' E., in search of pasturage for sheep. He returned in 1845 to occupy the ground, and in the course of his journey was obliged to leave his party, in pursuit of a native guide who had decamped with a gun. In mentioning this incident, Mr. Cay writes (25th March 1845): "I was rather cold that night, as I had come off after him in my shirt-sleeves; moreover, I had no dinner, but I got plenty of lerp. Lerp is very sweet, and is formed by an insect on the leaves of gum-trees; in size and appearance like a flake of snow, it feels like matted wool, and tastes like the ice on a wedding-cake."

On Mr. Cay's arrival in Scotland in 1847, he gave some further particulars regarding this substance, stating that it was produced in great abundance, and covered large tracts of the scrub-like snow; that it is very nutritive, the natives becoming fat during the season in which it is found, and that he himself had subsisted for a day or two upon it; that it adheres with very little tenacity to the leaves, and is immediately washed off by a shower of rain.

As it appeared from this description that the substance was unknown in this country, Mr. Cay, at his father's request, wrote to his overseer in Australia, who sent over the quantity of lerp which has formed the material for my observations, accompanied by a letter, dated 25th February, 1848, of which the following is an extract:—"The Blacks say the lerp is not in any way produced by an insect, but that it is a spontaneous production of the mallee or gum-scrub when very young, say a foot or eighteen inches high, and that it grows on either side of the leaf; that old mallee, or mallee about eighteen inches high, does not produce lerp. Therefore, this year they have burned as much of the mallee as they could to admit of the young mallee springing up."

The only published notice of this substance I have met with is contained in Westgarth's *Australia Felix,* page 73, where it is mentioned in the following terms:—" Mr. Robinson, the Chief Protector (of the Aborigines), ascertained during his expedition in 1845, to the north-west of Australia Felix, that the natives of the Wimmera prepare a luscious drink from the Laap, a sweet exudation from the mallee (*Eucalyptus dumosa*). This liquor is manufactured in the months of February and March, on which occasions there is commonly a festival, and adjustment of mutual disputes."

The substance to which these observations refer differs very strikingly in its external appearance from all the other species of manna. It consists of numerous small conical cups of the average diameter of one-sixth of an inch, with a more or less distinctly striated structure, and covered externally with a number of white hairs curled in various directions. These hairs are not distributed over the whole external surface of the cup, but are generally attached to the middle portion between its base and apex. The cup itself is generally sharply acuminated, and bears a pretty close resemblance to some of the smaller species of patella. Its interior is pretty smooth, its exterior rough, and its edge perfectly regular and round. The cup and hairs are translucent, except on the edge of the former, which is frequently opaque. No traces of attachment to the leaves of the plant were to be detected, and though fragments of leaves, obviously those of a species of *Eucalyptus,* were found in the substance, none of them had any of the cups attached to them. The cups were not generally isolated, but usually adhered loosely to one another by the edges; and this attachment was always such that the mouths of the cups were in one plane, and there can be little doubt that it was by this surface they were attached to the leaves. The hairs, when examined under the microscope, were found to be distinctly organized. Each hair formed a uniform tube, which, under a high magnifying power, presented a granular structure, with imperfect indications of transverse striæ.

When treated with potash under the microscope, they became very transparent, and lost their granular appearance, and a drop of solution of iodine coloured them uniformly blue; thus indicating starch as one of their constituents. The cup itself is composed entirely of a mass of cells resembling starch-globules, but so closely compacted together, that their characters can only with difficulty be made out. A thin slice, however, when macerated for some time in water, admitted of disintegration; and though most of the cells were broken up, a few could be distinguished in a pretty perfect state, and agreed in their appearance with those of starch. The whole cup is coloured blue by iodine.

The taste of lerp is distinctly saccharine, but this is confined entirely to the hairs; the cup when completely separated presenting only a slight mucilaginous taste.

The chemical examination showed that it differed as remarkably in constitution, as it does in form, from all hitherto examined species of manna. When boiled with alcohol, a large proportion is dissolved; but the solution deposits no mannite on standing, and when evaporated on the water-bath yields a thick syrup, which cannot be brought to crystallise. It is obvious from this fact, that it contains neither mannite nor the sugar obtained by Johnston from the manna of *Eucalyptus mannifera.* The sugar separated from lerp had all the characters of the uncrystallisable sugar obtained from fruits, and entered rapidly into fermentation when mixed with yeast. The residue from which the sugar had been extracted yielded to cold water a small portion of gummy matter, and, when boiled with water, a considerable part of it dissolved; and the filtered solution, on cooling, deposited a large quantity of a white powder, of sparing solubility in cold water. The fluid from which this substance had separated gave, with iodine, a strong reaction of starch.

The substance which deposited from the hot solution when washed with hot water until it no longer gave the reaction of starch was found to agree, in all its characters, with inulin; but in order fully to establish its identity, an analysis was made of the substance dried at 310°, of which the following are the details:—

$$\left\{\begin{array}{lll} 6\cdot441 & \text{grains gave} & \\ 10\cdot398 & \ldots\ldots & \text{of carbonic acid, and} \\ 3\cdot652 & \ldots\ldots & \text{of water,} \end{array}\right.$$

giving the following results per cent :—

Carbon . . .	43·90
Hydrogen . . .	6·29
Oxygen . . .	49·81
	100·00

which agrees perfectly with the results obtained for inulin from other sources.

The insoluble residue was likewise carefully washed with boiling water, and then constituted a white substance insoluble in water, alcohol, acids, and alkalies, and agreeing in its characters with cellulose. That it actually was this substance was determined by the following analysis of the substance at 212° :—

3·953 grains of cellulose gave
6·334 .... of carbonic acid, and
2·494 .... of water.

Carbon . . .	43·69
Hydrogen . . .	7·00
Oxygen . . .	49·31
	100·00

Traces of nitrogen, and of a waxy or resinous matter, were also detected; but of these, and more especially of the former, the quantity was too minute to admit of determination. When burnt in the air, it left behind 1·13 per cent. of a white ash.

The quantitative analysis of lerp presented some difficulties. These were chiefly experienced in determining the quantity of starch, which I at first attempted to do in the usual manner, by washing it out; but the hairs disintegrated under pressure, and passed in fragments through the cloth, so that I was under the necessity of abandoning this process, and determining it by difference. This was effected in the following manner: The residue, after extraction by alcohol and cold water, and which, of course, contained the starch, inulin, and cellulose, was weighed, and then boiled with water. The insoluble residue of this process, which was cellulose, was washed, dried, and weighed; the inulin which deposited from the boiling solution, on cooling, was likewise washed, dried, and weighed. The difference between the sum of these weights, and that of the whole original residue, was reckoned as starch. This method, which was the best the circumstances admitted of, is not one of very high accuracy; but I believe it to approximate pretty closely to the truth. I think it likely, however, that the starch is rather under, and the inulin overrated, as, owing to the slight solubility of the latter substance, it was impossible to carry the washing very far. The following are the results I obtained:—

Water	15·01
Sugar, with a little resinous matter	49·06
Gum	5·77
Starch	4·29
Inulin	13·80
Cellulose	12·04
	100·00
Ash	1·13

Such being the constitution of this curious substance, the question of its origin becomes of very great difficulty. All the species of manna regarding which we have explicit information appear to be exudations consequent upon the puncture of an insect, and they are composed of substances entirely soluble in water, which may easily be conceived to exude in solution, and gradually dry up in the rays of the sun, as indeed is actually the case with common commercial manna. But in this manna we have present the insoluble cellulose, with starch, which is absolutely insoluble, and inulin, which is sparingly soluble in cold water; and it is very difficult, under any circumstances, to suppose that these substances could have been produced as a consequence of a puncture; and still more so, when it is taken into consideration that the whole substance is possessed of a definite organization. It is true that certain insect punctures are followed by the production of a sort of organised excrescence on some plants; but in every instance these are excrescences in the strictest sense in the word, and are part of the plant upon which they are developed,—but lerp is manifestly an independent substance, the very attachment of which is not distinguishable; and I apprehend that far more distinct evidence than we now possess is required to establish its insect origin. The natives, as has been already mentioned, state that it is not produced by an insect; and though, under any other circumstances, the opinion of a tribe so unintelligent as the New Holland aborigines is not deserving of any attention, it is still of some importance when it tallies with the conclusion to which I think the chemical examination leads us. Entomologists to whom this substance has been shown are of a different opinion; and Mr. Newport, to whom specimens were sent, has gone so far as to establish, on the strength of it, an entirely new genus of insects, to which he has given the name of *Aspisarcus,* from *aspis,* a shield, and *arcus,* a net.* The consideration of this point, however, must be left to those who are more competent than I am to form an opinion. I have confined myself to determining its constitution, which appears to me altogether at variance with the idea of its being a simple exudation consequent upon the puncture of an insect.

XX.

On the Coal Measures along the Coast between Western Port and Cape Liptrap, in the Colony of Port Phillip. By G. H. WATHEN, *Esq., Mining Engineer.*

HAVING recently returned from an examination of the coast from Western Port to Cape Liptrap, with reference to the future working of coal in that district, I beg to make the following statement of facts for the guidance of those interested in the matter.

It has long been known that coal existed on this coast. More than once operations have been undertaken for mining it; but these, having been ill-devised and ill-directed, were successively abandoned.

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* Professor Balfour, in his Manual of Botany, p. 412, says: "A saccharine substance, mixed with cellular hairs, which arise from a cup-like body, has been sent to this country by Mr. Cay, found upon the leaves of *Eucalyptus dumosa.* It is called Layurp by the natives, and is thought by Mr. Newport to be the produce of an insect of the tribe Coccidæ."—*Editor Phil. Journal.*

The beach along the eastern shores of Western Port Bay presents trap and lava of various kinds, and in different states; in some cases hard and crystalline, in others decomposed or decomposing into soft rich-coloured earths and clays. The banks of the bay are generally low and sandy, but occasionally rise into bluffs from twenty to thirty feet high, formed of decomposed lavas.

The coal measures commence with a well-defined boundary about a quarter of a mile north-west of, or within Griffith's Point, opposite Cape Woolomai, in Phillip Island, at the eastern entrance to Western Port. Griffiths' Point is a bold headland presenting cliffs nearly a hundred feet high next the sea, and forming the termination of a range of wooded hills which run inland nearly east and west. The coal measures are immediately contiguous to the lavas, but whether they run beneath them can only be determined by boring or sinking. The workings carried on some years ago, under the authority of Mr. Cole, were on the shores of the bay between East Head and the mouth of the River Bass, at a spot where a portion or point of the coal measures protrude into the mass of the eruptive rocks; the former having been much broken and disturbed by the latter. In such a place no extended bed of coal could have been expected, nor was such found.

From Griffiths' Point the cliff towards Bass's Straits present a continuous section of the coal measures for a length of eight or ten miles to the River Bourne, known locally as the First River. Here the cliffs are succeeded by a range of sandy hummocks; but the coal measures probably extend beneath the surface, as they re-appear six miles further along the coast at Cape Patterson, where a natural section is displayed both in the low bluffs and on the beach. It is at this spot that the coal itself rises to the surface. Within half a mile of the Cape three seams crop out upon the beach, and are visible at low tide. Being half immersed in sand and water, their exact thickness and dip cannot be readily determined; but the following may be taken as an approximation to the truth.

	Thickness.	Dip.	
1st or West Seam of Coal	1ft. 8in.	25°	West.
2nd or Middle Seam	3ft. 4in.	20°	,,
3rd or East Seam	1ft. 8in.	20°	East.

Continuing along the coast, the coal measures are again displayed in section between Cape Patterson and Anderson's Inlet, both in the cliffs and on the beach. Opposite the entrance to the Inlet, the cliffs are succeeded by a low sandy flat, forming the entrance to the valley drained by the Screw Creek, which runs into the inlet near its entrance; but, after crossing the creek, the coal measures again crop out to the surface on the beach, and rise into low bluffs. They appear to continue along the northern shore of Anderson's Inlet to the River Tarwin, which is probably not far from their termination in this direction; for a few miles beyond, at Cape Liptrap, we find, together with large masses of intrusive greenstone, the underlying formations of mountain limestone and clayslate, the latter probably lying immediately upon the granite; which at Wilson's Promontory rises through the superior strata into a bold and lofty mountain range, forming the most southerly point of the Australian Continent.

Thus it appears that the coal measures extend almost uninterruptedly along the coast from Griffith's Point, at the east entrance of Western Port, to the River Tarwin, a distance of about thirty miles. They consist of a series of beds, such as in all parts of the world are associated with coal, presenting, however, certain characteristic modifications of their own. The upper strata consist of a hard conglomerate grit, with a thick bed of reddish brown sandstone variegated by veins and patches of redder tint. Beneath are a succession of beds of grey sandstone, hardened clay, black and blue shales, with seams of coal and fire-clay, and a conglomerate of rolled fragments of clayslate cemented together by a silicious paste. Imbedded in this conglomerate are found nodules (not rolled fragments) and irregular beds of a hard crystalline rock: these somewhat resemble in form and location, though not in mineral character, the "balls" and beds of iron-stone in the coal fields of England and Wales. Veins and bunches of lignite, and numerous fragments of fossil wood, are also found embedded in the grey sandstone. This sandstone offers another peculiarity. Portions of the beds near their surfaces have undergone a complete change, and have now a hard and blackened surface and fracture, and a prismatic structure, presenting all the appearance of the influences of igneous agency. It might have been supposed that this change originated in these parts having been in contact with igneous rock; but the fact that the unchanged sandstone lies immediately upon that which has been metamorphosed proves such an hypothesis to be incorrect. This hardened sandstone occurs, not in continuous beds, but in detached patches, which, being better able to resist the erosion of the waves, rise above the level of the contiguous rocks, and present much the appearance of worn street-paving.

The coal measures are much heaved and dislocated by trap dykes and other eruptive rocks, but their average dip appears to be to the west and north-west; and hence at Cape Patterson, the most southerly point in their range, the deeper beds crop out to view.

Cape Patterson, where the coal itself rises to the surface, is rendered wholly inaccessible from the sea by a heavy rolling surf, while it is just midway between two points of shipment, being about fourteen miles from Western Port on one side, and from Anderson's Inlet on the other. But though not visible at the surface, there is good reason to believe that the Cape Patterson coal seams extend with the other carboniferous strata from Griffith's Point to Anderson's Inlet, at either of which places they might be advantageously worked. Indeed, a thin seam of coal has actually been worked at a former period not very far from Griffith's Point; while at Anderson's Inlet three seams of black coaly shale crop out, very similar in character to beds which at Cape Patterson are closely associated with the coal. The actual existence at these points of shipment of the Cape Patterson seams, or of any other and perhaps richer deposits, together with their thickness and depth from the surface, can only be determined by boring.

The first operation, then, for any parties intending to mine for coal should be to cause a deep boring to be made near Griffith's Point, and another at Anderson's Inlet, to prove the actual nature of the successive strata. And when the existence of good seams of coal at either place has been thus proved, their superficial extent might readily be determined by other borings, at certain distance from the first. These borings might be carried on at a moderate expense, and by this mode of proceeding all possibility would be precluded of a lavish and profitless outlay in sinking pits for beds of coal which did not really exist, or were not worth working. In short, the adventurers would reduce their speculation almost to a certainty.

As regards the quality of the coal hitherto found, it will be enough here to say that the thickest or middle seam is of first-rate excellence, well fitted for the forge and for domestic use, and abounding with gas for lighting. It is also very readily worked. The west seam is of an inferior kind, and carries embedded in it a thin band of shale. The fire-clay

with which the coal is associated would itself prove of considerable value in the construction of furnaces, smelting works, &c.

It may be necessary to say a few words as to the practicability of using Anderson's Inlet as a place of shipment, which has been questioned by some. It is affirmed by a whaler, who has often visited the place in his boat, and is well acquainted with the whole coast, that the inlet would be accessible to coasting craft under all ordinary circumstances, and that, were it not for want of shelter outside the bar, it would form a better harbour than Port Albert. This statement is confirmed by the map of the Surveyor sent by Government to take soundings in the Inlet, from which it appears that there was then an entrance-way through the bar, five feet deep in the shallowest part at low water.

Should the coal be worked either at Western Port or at Anderson's Inlet, a jetty and railway might easily be constructed, by means of which the coal waggons would carry direct from the mouth of the pit to the spot where the vessels were moored and unload into them. A great saving of expense would thus be effected. If, on the other hand, any workings should be undertaken at Cape Patterson, a road or railway must be constructed for at least twelve or fourteen miles along the coast; and carriage for this distance must in that case be charged upon every ton of coal consumed at Melbourne.

The coal measures extend inland to an unknown distance, but the advantages of working them on the coast are too obvious to need remark.

This is not the place to enter into detailed calculations of the profits which might be expected by a coal-working company; but that they would be ample can scarcely be doubted when coal, after being carried eight hundred miles, is selling at the Wharf at Melbourne for thirty shillings a

ton, that price being due to the high rates paid for freight. It is stated on good authority that, if supplied at a moderate price, four hundred tons of coal a week, or 20,800 tons annually, would be consumed at Melbourne for steam engines, foundries, and other works. As regards the probable consumption for domestic purposes, it appears from official returns that there are about 3500 rate-paying families at Melbourne. Assuming that each family uses on the average twelve loads of wood annually, and taking three loads of wood as equivalent to one ton of coal, we should find that each family would consume four tons of coal a year, and that the total consumption for domestic use would be 14,000 tons annually. If we assume that for private purposes coal would supersede wood as fuel only to the amount of two-thirds of the actual consumption, we should still have a total of upwards of 30,000 tons as the annual consumption of Melbourne alone, in its present state of half development.

XXI.

On the Introduction and Naturalization of Petaurus sciureus *in Tasmania. By* R. C. GUNN, Esq., F.L.S.

[*Read 25th October,* 1850.]

IN the year 1845 I drew the attention of the Tasmanian Society to the interesting fact that the *Petaurus sciureus* (*Desm.*) or Flying Squirrel, of Port Phillip, was becoming naturalized in Van Diemen's Land, as several individuals had been killed in a forest near my house, in the vicinity of Launceston (*Tasmanian Journal,* vol. ii. p. 458.)

Subsequently, in April, 1846, Dr. James Grant, of Launceston, announced to the Tasmanian Society that a specimen of the *Petaurus* had been brought into town

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	Inches.
Mean Pressure for the year, corrected down to Standard Temperature of 32° Fahrenheit, from observations at 5 hours out of the 24	29·748
Mean Temperature for the year, from observations at 5 hours out of the 24	51°

The cistern of the Standard Barometer of the Royal Observatory is 107 feet above the level of the mean tide, causing a depression in the mercurial column of about 0·1 inch.

Quantity of Rain which fell in the Year 1849, *as denoted by the Self-registering Rain-Gauge at the Observatory.*

	Inches.
January	0·72
February	1·02
March	2·37
April	1·46
May	4·53
June	1·52
July	5·99
August	2·74
September	1·91
October	1·41
November	8·94
December	0·90
TOTAL	33·51

General Remarks upon the Weather during 1849.

There was an intensely hot wind on Saturday, the 27th January, which continued throughout the night, and until the afternoon of Sunday, when the atmosphere was relieved by a violent thunder-storm and heavy rain. During the continuance of this hot wind the Thermometer stood in the shade as high as 105°.

This was the only hot wind of any note throughout the year.

The principal feature in the weather during 1849 was the unusual quantity of rain which fell—considerably more than has yet been registered in any year since the establishment of the Observatory in 1840. It has entirely contradicted the assumption (which the observations of previous years had warranted) of the alternation of wet and dry seasons. The months of May, July, and November were particularly distinguished; and in the latter month alone there were 9 inches of rain—a very unusual monthly quantity for this climate. The mean temperature of November is below the average, owing to the constant wet, cold weather: and at Midsummer—viz., on the 23rd of December—Mount Wellington was completely covered with snow, extending down to the low hills in its vicinity. The weather during the night of the 22nd of December, and morning of the 23rd, was as severe and inclement as during any day in Mid-winter.

XXIII.

On the Construction of Dams, with a View to Irrigation. *By* SIR W. T. DENISON, F.R.S., *&c.* [*Read* 11*th* *December,* 1850.]

As the subject of Irrigation is one of much importance to the interests of the agriculturists and flockowners of this colony, any information connected with the subject, or with the mode in which it may best be carried out, will be useful. I have therefore thought that a paper on the construction of Dams, which was contributed by me in the "Aide Memoire" of the Corps of Royal Engineers, and which treats of the modes of constructing such works in a rapid, yet substantial manner, of materials easily procured, would not be unacceptable to the Royal Society.

DAM,—a bank or obstruction built across a river or stream for the purpose of raising the level of the water on the upper side of it.

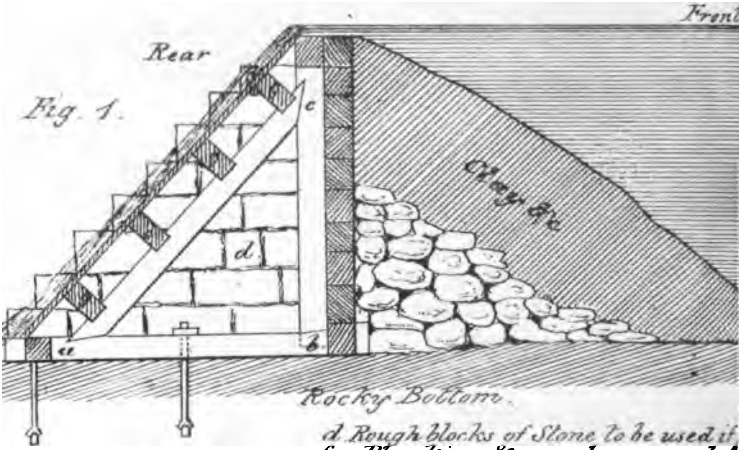
There are many objects for the attainment of which it may be necessary thus to check the course of a stream, and gain a head of water. It may be requisite to turn it for a time into another channel—to inundate the ground in front of part of a military position—to make a portion of the stream unfordable—to secure depth sufficient to enable vessels of a given draught of water to navigate the stream—or to gain a power to be applied to mechanical purposes. The works for the attainment of the first three of these objects belong more particularly to the class which officers may be called upon to execute in the course of a campaign; and the details here given refer entirely to works composed of such materials as may be expected to be within reach of an officer on service.

Dams built for the purpose of inland navigation, or for that of securing a water power, may be considered as having a more permanent character, and will be treated of in the second volume of this work.

The first consideration in forming a dam across a stream is the choice of a proper site. This must, of course, be decided with reference to the objects to be attained by the rise of water; but there are a few general rules to which attention should be paid.

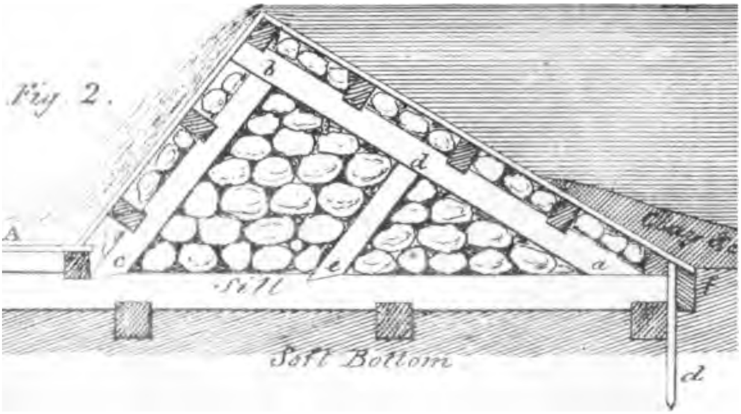
In streams liable to sudden floods it would be advisable to carry the dam across the widest part of the stream, so as to allow ample space for the water to flow over, and thus to prevent any sudden and great rise above the dam; or it may even be advisable to carry the dam in an oblique line across the stream. In rivers, where much drift wood is likely to be brought down, the dam should be situated below a bend in the stream where an eddy is formed, by means of which the collection and removal of the timber will be facilitated.

Section of a Dam on a Rocky Soil.



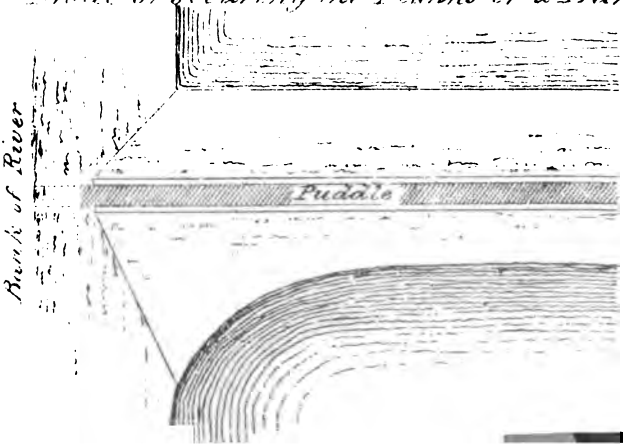
d. Rough blocks of Stone to be used if
f. g. Planking & cross beams subst
when d cannot be obtained, the
to be filled as in Fig. 2.

Section of a Dam in a Soft Soil.

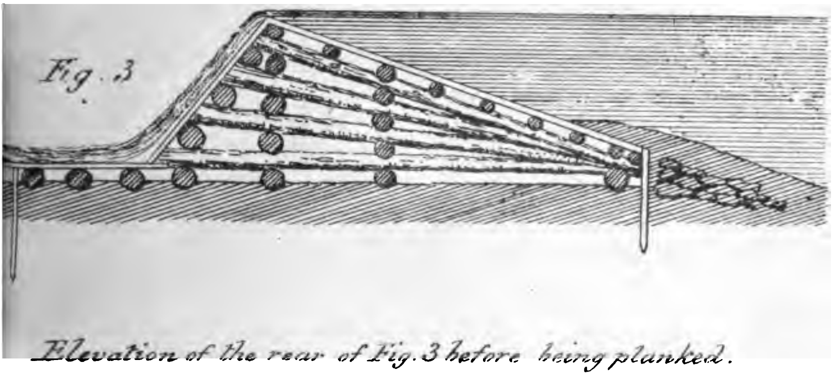


Mode of securing the Flanks of a Dam

ig. 3.



Section of a Dam on Soft Soil where Timber is plentiful.



Elevation of the rear of Fig. 3 before being planked.

4.

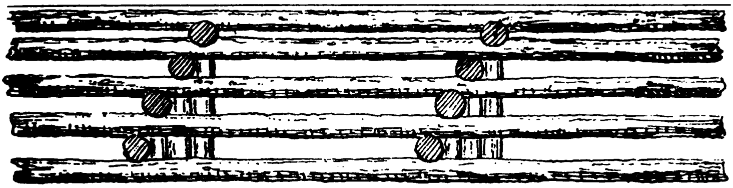


Fig. 5
Plan of Fig. 6.

rs 5.6.
work.

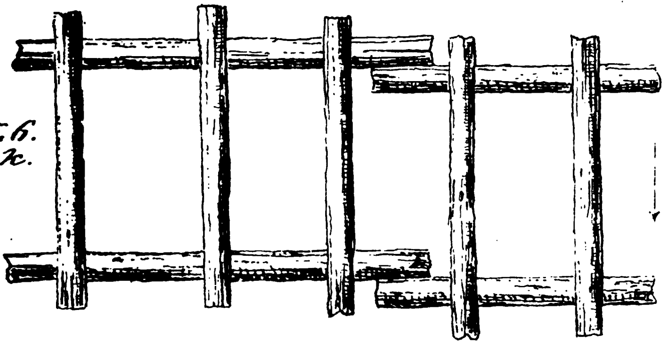


Fig. 6
verse Section of Fig 5.

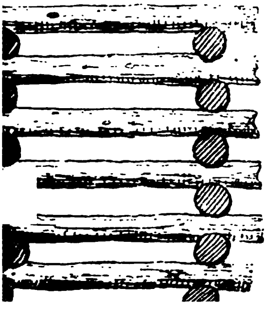
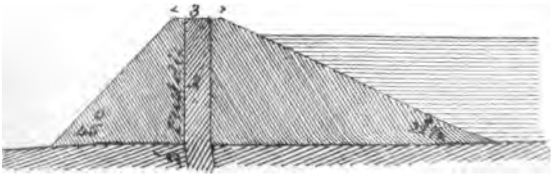


Fig. 7.
Transverse Section of a Puddled Dam.



The banks of the river or stream should be carefully examined with reference to the quality of the soil of which they are composed, and their power of acting as abutments to the dam.

When the site of the dam has been decided upon with reference to the principal objects which it is intended to answer, the necessary levels must be taken, and the height of the structure determined. Upon this will depend, in a great measure, (when materials are plentiful), the plan to be adopted in forming the dam.

In shallow rivers, when the bottom is rock, a dam of the section shown in *(plate* xix.*)* fig. 1 may be easily constructed of 10 or 12 feet in height. The sill (*a b*) is bolted down to the rock with fox-wedge bolts. The standard (*b c*) is mortised into this sill; and a brace (*a c*) is framed into the two, making thus a strong vertical frame. When the dam is high, a second brace may be inserted, and the horizontal distances between the frames diminished; but, in general, 8 or 10 feet may be allowed as a fair distance between these frames from centre to centre. When the frames are securely fixed, a facing of logs, roughly squared on the upper and under sides, is laid in front of them, across the bed of the stream. These should be got as long as possible, and should break joint occasionally against a standard, to which they should be sometimes pinned with a trenail, in order to prevent their moving.

When the water is intended to flow over this dam, the space between the frames in the rear should be filled in with blocks of rough stone, well wedged together, and laid in steps, so as to break the fall of water on the bed of the river in rear. If material of the proper quality cannot be found, or if the time will not allow of its being quarried and placed properly, this space may be filled in with earth and rubble; and logs being notched down upon the back braces of the frame, stout planking should be spiked over these logs, so as to present a smooth surface for the waste water to flow over, and to act as a protection to the stones, earth, &c. below. The front of the dam should also be filled in with earth, rubbish, &c.; and if the surface of the rock is so uneven as to prevent the front logs bearing fairly upon it, brushwood and fascines may be placed in front, so as in some measure to close the spaces between the rocks and the logs.*

When the bed of the river is composed of sand, clay, or material too soft to resist for any length of time the action of the water, the plan shown in figure 2 may be advantageously adopted. This frame is composed of a sill, extending not only the width of the dam, but also of the apron in rear, notched down and pinned to three or more sleepers, which are laid transversely to the stream, and sunk into the bed of the river. Into this sill, the beam (*a b*) is framed at an angle of about 30° with the horizon, and supported in this position by the two struts (*b c*) (*d e*) at an angle of about 60°. These frames are placed at about 8 feet apart, and upon them are notched the horizontal beams which carry the planking with which both the up and down stream sides of the dam are covered.

In order to prevent the water making its way under the dam, a row of plank piling (*d*), about 5 feet long and 4 inches thick, should be driven in front of the upper sleeper, and a line of waling (*f*) upon this row of piling should be well spiked through the piles into the frame. In order to secure the work more completely against leakage, clay should be thrown in front of the sheet piling to a height of one or two feet. An apron (A,) as shown in figures 2, 3, is a necessary addition to every dam constructed across a river when the bed has not sufficient tenacity to resist the action of the water. This may be composed of logs notched upon the sill pieces and covered with plank, or of rough logs notched and pinned down upon the sleepers in close contact with each other: it should extend far enough below the dam to conduct the water away safely, and should have a row of sheet piling in rear, as shown in figure 3.

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* Occasionally, when the strata cross the bed, and particularly when they crop out against the stream, great additional stability may be obtained by abutting the lower parts of the dam against the basset edges of the rock.

Where rough timber is plentiful, a dam, as shown in figures 3 and 4, may be easily and quickly constructed thus: two or three rows of rough sleepers are bedded across the stream, and upon these rough logs are notched and pinned at intervals of about five feet in the rear of the dam. Over one of these sleepers another transverse log is notched upon the first row of longitudinal timbers; and if the dam is a large one, perhaps a second transverse timber may be required. The second row of longitudinal timbers is notched upon the second row of transverse timbers, not exactly over the first row, but just so much clear of it as to allow of the end being notched and pinned upon the groundway or sleeper at the upper side of the dam, close alongside of the first timber. Row after row of timber is thus placed, the dam constantly rising in rear by the thickness of a log for each course, while in front all are brought down and pinned to the ground-way. When the necessary height is obtained, the top row of longitudinal timber may be laid side by side in as close contact as possible, and the spaces made good with small fascines, bark, &c.; or rows of transverse logs may be placed at about three feet apart, and planks spiked to them. The rear of the dam appears, as shown in the sketch figs. 3 and 4, of alternate rows of longitudinal and transverse timbers to which planking is spiked.

Where timber is plentiful, and the river is deep, a dam may be safely constructed to a great height of crib-work, that is, of a series of rough cases formed of whole timbers, notched together at the crossings, as shown in figure 5.

In framing a dam of this description, two logs are laid in a direction transverse to the stream at the same distance apart as is intended for the width of the dam; upon these cross logs are notched at distances of 6 or 8 feet: other transverse timbers are notched upon these, and the dam is carried up in this way until it arrives at its intended height. Sometimes it may be advisable to divide the interior space into smaller compartments, by introducing more transverse timbers; during this, very little impediment has been offered to the stream which flows through the interval between the logs. * When the crib-work is complete, the spaces between the cribs are filled with stone if it can be procured; or if not, with fascines, earth, &c., and a mass of earth and rubbish is thrown into the river in front of the dam, so that by degrees a mass is accumulated sufficient to prevent leakage. This work is carried on simultaneously from both banks, and as the water is checked, so the stream rises above the dam, rushing through the central space left for its passage. The same process may be continued till the dam is completely closed; but as large quantities of earth, &c. would be washed away in attempting to close the opening between the logs in this centre bay, the best plan is to prepare a frame to receive a sort of gate made of logs, which can be dropped down from above, and which will close the opening sufficiently to prevent much waste of material taking place. †

When timber is scarce, fascines and hurdles may be used

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[*] In executing this sort of work, the first logs float on the water, and are gradually sunk by the increasing superstructure.

[†] Experience has likewise shown, that when the water is deep and even rapid, the front of the dam may in like manner be formed of portions of crib-work, two bays in length, constructed ashore, dropped down into position and arranged on the arc of a circle in plan, beginning from each flank, filling them as soon as properly placed. This, as the body of the dam, must be assisted and supported by slopes of clay, as in figs. 1 and 2.

in the construction of dams. In Holland and Germany they are very commonly employed for this purpose. A course of large fascines is first laid, the length of the fascines being in the direction of the current, and each in as close contact as possible with its neighbours : upon this a second course is laid transversely, strong pickets are driven through these two courses to connect them together, and the heads of these pickets are wattled together so as to make a kind of hurdle-work, which serves to connect the whole more completely into one mass; these layers of fascines are then continued in the same manner, each course being picketed to those below, and the pickets connected at top with hurdle work, until the dam has attained the proper height. Very large rivers, with a great depth of water, have been successfully dammed up and their courses changed by works constructed in this manner. Where the water is deep, gabions loaded with stones, square wicker baskets, filled with stone, &c., have been used to form the foundation of the dam; and upon this a superstructure, as before described, has been raised.

The above are a few of the most simple and of the readiest modes of constructing dams; modifications may of course be made to any extent: two or more of these plans may be combined in the construction of a single dam—as, for instance, the sides of a dam when the water is shallow may be made according to figure 1, and the centre part with cribs, as in figure 5.

The flank of the dam should be secured by being let into the bank and puddled in front, and the earth or rubbish which is thrown in front should be carried up the river against the bank to a greater distance than at other points.

As a general rule, the sides of a dam should be first constructed and the abutments made good;—serious accidents have occurred from a neglect of this precaution.

Should it be decided to raise the water so as to inundate the banks on each side, the embankment to prevent the water thus raised finding its way round the flanks of the dam,—these flanks should be completed before the dam itself is closed. This embankment may be formed of earth; its section may be as in figure 7, about three feet thick at the top, which should be about one foot above the highest water line, the upstream slope at least 2 of base to 1 of height; the down stream 1 of base to 1 of height: in case the soil is light and porous, it will be necessary to excavate a trench in the line of the embankment, about two feet into the ground, and about two feet wide; to puddle this well with clay, and to form a wall of the same through the centre of the embankment, till above the water line, as in figure 7, to render it water-tight. Where a current can act upon it, the base may be protected by stones, and by planks or fascines pinned down parallel to its direction. In all cases ample provision should be made for the passage of the waste water; when it is not allowed to pass over the dam, waste channels should be made, and the passage of the water through these, regulated by sluices, either self-acting (which is the safest plan), or worked by men. Great care must be taken that the action of the water through these sluices does not tear up and wash away the ground below to an extent to endanger the structure. Aprons (constructed as before described) must be laid in rear of the sluices, except when these are fixed upon rock, and must be carried down to a distance proportional to the body of water discharged, and to the fall, also taking into consideration the nature of the soil.*

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* Bridges may often be converted into temporary dams by blocking up the archway, taking care that the mass thus formed is sufficient to support the accumulated body of water, which must not be taken for granted with most bridges.

XXIV.

Analysis of Coal *from Van Diemen's Land; with Report.* *By* SIR H. DE LA BECHE, C.B., F.R.S., &c. &c. [*Read* 11*th December*, 1850.]

(*Enclosed to* SIR W. DENISON *in a Despatch from* LORD GREY.)

Geological Survey of the United Kingdom,
Bastow, Chesterfield, Derbyshire,
27th July, 1850.

SIR,—I have the honour herewith to transmit, for the information of Earl Grey, the Analysis made at the Museum of Practical Geology, London, of specimens of Coal from Van Diemen's Land, forwarded for examination by Sir William Denison.

Though several of the Coals, as far as they are represented by the specimens, do not appear of good quality, nevertheless there are two (from Adventure Bay and Douglas River, East Coast), which so much approximate to good Newcastle Coals, though with a large amount of ash, that it may be very desirable somewhat fully to explore the localities whence these Coals are derived, in order to ascertain their thickness, mode of occurrence, and other circumstances connected with them, and perhaps also with other associated Coal Beds.

When it is considered how little would be known of some of our British Coal Districts if they were situated in distant and little explored regions, from the somewhat rapid views usually taken, and which can be expected from mere general examinations of country, it seems desirable carefully to ascertain the workable value of any Coal that may be discovered in Van Diemen's Land,—so that, while on the one hand thin seams, however good, may not have a false value attached to them; on the other, thick beds, though of inferior quality, should not be neglected, always supposing that their mode of occurrence, and the importance of the Coal as fuel, are such as to justify their being worked.

It may be desirable to add, as regards information to be derived from the analysis of the specimens of Coal usually obtained during the ordinary first exploring of a country, that such specimens are commonly of worse quality than the beds whence they have been derived, when these beds are worked at sufficient depths from the surface of land to secure them from the destructive action of atmospheric influence.

I have, &c.,
(Signed) H. T. De La Beche.

B. Hawes, Esq., &c. &c.

ANALYSIS *of* COAL *from Van Diemen's Land.*

(Referred to in the Report of the Lieutenant-Governor, dated 18th May, 1849.)

LOCALITY OR NAME OF COAL.	MEAN COMPOSITION OF AVERAGE SAMPLES OF COAL.						REMARKS.
	CARBON	HYDROGEN.	ASH.	SULPHUR	NITROGEN.	OXYGEN.	
South Cape	63·33	2·89	29·96	0·98	1·27	1·57	Very large amount of ash, carbon poor, quality indifferent.
Mount Nicholas, Break o' Day	57·38	3·93	27·55	0·90	1·15	9·09	Quality very indifferent, carbon poor.
Fingal	57·21	3·40	29·10	1·32	1·20	7·77	Same quality as last.
Jerusalem	68·17	3·97	19·22	1·12	1·62	5·90	Better quality, approaching Newcastle coal, ash still large.
Douglas River, East Coast	70·44	4·20	14·50	0·70	1·12	9·04	Good quality, like Newcastle, but large quant. of ash.
Tasman's Peninsula	65·53	3·34	26·40	1·03	1·89	1·81	Indifferent.
Schouten Island	64·00	3·54	27·17	0·85	0·94	3·50	Indifferent.
Adventure Bay	80·20	3·05	8·67	1·90	1·36	4·82	Best specimen, like good Newcastle, though the ash is also large.
Whale's Head & South Cape	65·85	3·18	21·50	1·14	1·32	7·01	Indifferent, ash large.

N. B.—These Coals all contain a large quantity of ash. The amount of sulphur is not remarkably large in any of them, but still considerable. The coals cannot be considered as being at all first-class coals, but still they may be of much value in a colony so distant from the European Coal Fields as Van Diemen's Land.

Museum of Practical Geology, 26th July, 1850.

(Note.—It is possible that a mistake may have been made between the Adventure Bay and the Mount Nicholas Coal. Specimens of each will be sent to England for verification.)

R. Pugh, Esq., M.D.

6.

Winds.													
k a.m.					3 o'Clock p.m.								
W.	S.	S.E.	E.	N.E.	Calm.	N.	N.W.	W.	S.W.	S.	S.E.	E.	N.E.
5	...	2	...	...	3	1	17	4	4	...	2	...	...
3	...	2	...	...	6	2	12	2	5	...	1	...	...
2	...	1	...	...	5	2	17	2	3	2	...	...	...
..	...	2	...	1	6	2	11	2	3	3	3	...	...
1	...	4	...	...	12	3	10	...	2	...	2	2	...
1	1	5	1	...	10	4	7	...	...	1	5	...	3
..	1	8	1	2	8	2	6	1	...	2	10	2	...
..	...	5	...	...	8	...	17	...	1	...	5	...	...
..	...	4	...	...	3	1	19	...	2	2	3	...	...
..	...	4	...	1	3	...	24	...	...	1	3	...	...
1	...	5	...	1	4	2	17	1	1	...	4	...	1
..	...	1	...	...	6	2	20	1	1	...	1	...	...
3	2	43	2	5	74	21	177	13	22	11	39	4	4

[illegible]
after a season to disappear from flocks all but universally affected by

secure them from the destructive action of atmospheric influence.

I have, &c.,
(Signed) H. T. De La Beche.

Proceedings.

9TH JANUARY, 1850.—Monthly evening meeting; Joseph Hone, Esq., in the chair.

The following gentlemen were ballotted for and elected Fellows :—

Henry Butler, of Hobart Town; Frank Butler, of Hobart Town; Phineas Moss, of Hobart Town, Esquires.

The Secretary reported that His Excellency Sir W. T. Denison, President of the Society, had forwarded to the Museum a valuable collection of shells from the eastern shores of Central and South America, specimens of metallic minerals from Chile, and of native sulphur from New Zealand.

Major Cotton, Deputy Surveyor-General, sent specimens of transition slate and quartz from the Huon River, nearly opposite Lake Pedder; of greenstone from Mount Picton; and of clayslate and micaceous schist from the Frenchman's Cap mountain; also, the palm-like head of a tree of *Richea Pandanifolia* from a ravine in that neighbourhood, the stem of which measured 40 feet in length.

J. E. Bicheno, Esq., sent a good specimen of *Fungia Patellaris;* a specimen of native sulphate of magnesia of Tasmania; also, a large concretionary mass said to have been taken from the stomach of a sheep. It was remarked that concretions of this description have usually a dirty yellowish green colour, and the figure of a sphere or ball variously flattened, with a diameter of one to two inches only; that they are composed of thin layers of finely subdivided and closely compacted vegetable fibre; that they have been found to affect sheep in almost every district of the Island, and generally without sensible detriment to health or condition; and that they have been known after a season to disappear from flocks all but universally affected by them. It would appear, therefore, that these concretions are not caused by noxious and poisonous herbage peculiar to certain tracts of land, and eaten as food by sheep as had been supposed, but that the *nucleus* around which there is a continual accretion of thin laminæ is the result or residuum of imperfect action on the part of the ruminative and digestive organs—a condition which may in all probability be obviated or removed by the introduction of bitter and aromatic plants; such as parsley, thyme, chiccory, clover, &c., amongst the few comparatively sapless indigenous grasses which constitute the natural pasturage of Van Diemen's Land.

The Reverend R. K. Ewing, of Launceston, forwarded a specimen of curiously fluted and stalactite-looking *Iron Pyrites* from Mr. De Little's Lime Quarry, near York Town, on the Tamar River.

James Barnard, Esq., presented a fragment of calcareous spar, seemingly detached from trap rock, with a specimen of micaceous schist from the estate of B. Berthon, Esq., at the Cross Marsh; also, a fragment of fine Porphyry from the beach at Sandy Bay, having a red jasper-like matrix thickly studded with serrated white points like minute portions of shell or the points of shark's teeth.

Mr. Worley presented a few shells from the Islands to the north and eastward of Australia.

Mr. Loughnan submitted for examination a sample of starch from his manufactory in Campbell-street.

Mr. A. M. Milligan, of Launceston, sent a few scarce coins—gold, silver, and copper.

Samuel Moses, Esq., presented an extensive assortment of coins and medals of ancient and modern times in a good state of preservation; also some beautifully crystallized specimens of blue and green carbonates of copper from Adelaide. Mr. Moses submitted for examination samples of a consignment of ores shipped as *Copper Ore* from the islands called the Chickens, in the Bay of Wangari, New Zealand: it was found to consist of *Iron Pyrites*, *Iron Glance*, and earthy matter.

John Kerr, Esq., M.L.C., presented a purse of coins of ancient Rome, and of England and Scotland, from the time of Elizabeth and James downwards.

W. Champ, Esq., forwarded from Port Arthur for the Museum, a little spotted fish belonging to the genus *Chironectes*, preserved in spirits, together with specimens of a small *macrourous* crustacean, probably a *Palæmon*. Mr. Champ writes thus respecting the frog fish :—"It was found in the sea at Port Arthur by a person who was with me, and when caught had all the appearance of having four legs, from the position and shape of the fins; the two longest of which, from the sort of elbow in them, and the division into (rays) what resemble fingers, seem to form a connecting link between fins and legs or arms."

Of the crustaceans Mr. Champ says :—"If they should turn out to be young lobsters the fact is worth knowing, quantities of them having within these few days been found in Opossum Bay, at Port Arthur."

Mr. Hull presented specimens of fossil shells from the *spiriferous* Limestone cropping out at Tolosa, of the common *Helix*, or large existing snail shell of Tasmania, the cranium of the *Echidna setosa* —a dried specimen of *Callorynchus Australis*, and a spirit preparation of a large Tasmanian Lizard, closely resembling that figured by Darwin (Zool. of the Beagle, vol. iii., plate xv.), as *Cyclodus Casuarinæ*, and said by him to resemble the snakes in its mode of progression : there is an opinion commonly prevalent in Van Diemen's Land, and it obtained also amongst the Aborigines of the Island, that this Lizard is venomous.

From Mr. Propsting, of Elizabeth-street, was received a fine stuffed specimen of the Australian Goshawk. (*Astur Approximans*, Vig. and Horsf.)

Mr. Milligan read a paper illustrated with an ample series of specimens, upon the occurrence of *Galena*, with traces of copper in the old siliceous limestone, for some years quarried and burned for lime upon the property of Mr. Abraham Walker, at the western side of Norfolk Plains, and immediately under Dry's Bluff, a portion of the western range of mountains.

Thanks were voted for the donations and paper, and the meeting, after some discussion, broke up.

13th February.—Monthly evening meeting, Joseph Hone, Esq., in the chair.

The following gentlemen were ballotted for, and duly elected Fellows of the Society:—Gother Mann, Esq., of Sydney; Thomas Arnold, Esq., Inspector of Schools; D.A.C.G. Mitchell, J. Boyd, Esq., F. C. Tribe, Esq., J. C. Jervis, Esq., of Hobart Town. T. J. Lempriere, Esq., A.C.G., was admitted upon Rule xvii.

The Secretary reported that Dr. Pugh, of Launceston, has forwarded his Meteorological Tables for 1849, to be published in the journal of the Society; that a book on "the Earth's Antiquity" has been received from the Dean of Westminster, through J. E. Bicheno, Esq.; that Sir William Denison has sent to the Society's Gardens a case containing *Para Grass*, forwarded from the Botanic Gardens at Kew by Sir William Hooker: and that a box of ores of copper, from the Burra Burra mines, has been presented by Sir William Denison to the Museum. A collection of prepared skins of birds of Tasmania was received from Miss Denison.

Mr. Bicheno sent for examination a fragment of freestone from the High School, having a pale blue colour, which it is said to have acquired from contact with the timber of the Huon pine.

Mr. Phineas Moss presented a few insects collected by himself at South Australia.

Mr. Mort, of Sydney, has forwarded to the Society's Gardens a case of valuable exotics, besides plants indigenous to Australia.

Mr. Mackinnon, of Selma, on the South Esk, presented for the Museum a relic of the celebrated *Flora Macdonald.*

From Mr. A. B. Jones and Mr. Philip Stanley Tomlins were received for examination curious thin saucer-like forms recently found on the sea-beach at the Retreat and South Port respectively: they seemed to be formed of sand mingled with the roe of fish, and fixed in the cake-like shape they possess by the glutinous matter involving the *ova.*

Mr. Sharland, M.L.C., sent for examination fragments of an *obsidian*-looking mineral from his estate north of Hamilton, where it is said to occur in considerable abundance, and massive: it will probably prove a variety of wood opal.

Mr. Douglas, of the Ordnance, presented mineral specimens collected in Kerguelen's Land by the officers of the Erebus and Terror, with some sea shells.

Mrs. J. Kerr, of Fitzroy Crescent, sent a small collection of coins for the Museum. Mr. H. Hull presented two specimens of fossil wood from the Old Beach, where it is said to be plentiful on the surface of the ground.

Mr. Lievesley presented for the Museum a dried fish (not named) from Honolulu, at one of the Sandwich Islands, together with a packet of seeds of a plant met with in the neighbourhood of San Francisco.

A.C.G. Lempriere sent for the library a folio atlas, curiously embellished, having been published so far back as 1715.

Mr. Milligan placed on the table a suite of beautifully distinct impressions and casts of stems and leaves of *ferns*, *strap-shaped leaves*, *calamites*, &c., recently obtained in the soft schistose clays and sandstones interposed between the seams of bituminous coal cut through in the shaft now being sunk near Wabb's Harbour on the East Coast; also read a letter from P. S. Tomlins, Esq., A.P.M., South Port, descriptive of a meteor observed by him there on the morning of the 10th instant.

A letter from Mr. Boot, on the valuable products recently stated in the House of Commons to have been obtained on the large scale from Irish peat, was communicated to the meeting.

Conversations on the subjects before the meeting were maintained till nearly 10 o'clock, when, on the motion of Dr. Officer, seconded by Dr. Turnbull, the thanks of the Society were voted for various donations and communications, and the members separated.

13th March.—The monthly evening meeting, held in the Museum and numerously attended. His Excellency Sir W. T. Denison, President, occupied the chair.

Mr. Thomas Browne, of Macquarie-street, and Mr. Walch, junior, of Elizabeth-street, were ballotted for and duly elected into the Society. The Secretary placed on the table several spirit preparations of fishes from the Estuary of the Derwent, and the bay and waters adjoining; amongst them was a fine specimen of the cuttle-fish tribe, closely resembling the common Calamary (*Loligo Vulgaris*—Lam., *Sepia Loligo*—Linn.), a rough pencil sketch, of the natural size, was exhibited. Dr. Turnbull stated, that on more than one occasion he had caught these *cephalopods* in the estuary between this and Risdon; that they are remarkable for a chameleon-like power of changing colour when captured, and that they emit a very distinct scream at the moment of seizure. It appears that the individual under examination was taken in the bay, fixed by his cup-like suckers to the back of a fish brought up with hook and line.

The Secretary submitted an inflated specimen of *Diodon* or globe-fish, taken by the aborigines near Oyster Cove, in D'Entrecasteaux Channel.

One egg of the ostrich, with two perfect specimens of *Cassis tuberosa*, were presented from Mrs. Garrett, of Macquarie-street.

Sir William Denison placed before the meeting a specimen of of *Lignite* converted into *jet*, obtained by His Excellency in the bed of the Ouse river. Sir William also submitted a specimen of iron ore, procured in the vicinity of the Mersey river by one of the district surveyors.

A specimen of *Hematite* ore of iron was submitted for examination, having been forwarded from Break-o'-Day Plains by Mr. Groom.

Specimens of *iron pyrites* (yellow variety—*mundick* of miners) from the Lake country were submitted, having been forwarded through Mr. Barnard by Mr. Berthon, whose shepherd had collected them.

Mr. Hull sent some well grown and productive ears of *millet* raised at Tolosa.

Mr. Makeig, of the Treasury Department, presented two ornamented waist belts of aborigines of the Fejee Islands.

The Secretary placed before the meeting a sample of *Manna*, obtained from the *white gum-tree* in the Domain here. A discussion arose as to the season when it appears—the tree on which it is found—and the mode of production; in which Mr. G. W. Walker, Mr. D.A.C.G. Mitchell, Mr. Hone, Major Last, Dr. Agnew and others, joined.

The Secretary submitted a small (probably undescribed) hairy Crab, caught about the level of low-water mark on the rocks near "the Snug" point, in D'Entrecasteaux Channel. It is remarkable for the size and comparative strength of its claws, and for its lurking in a state of perfect concealment under a red membrane-like covering, from which it springs on its unwary prey. It much resembles the *Dromia hirsutissima* of the Cape of Good Hope.

The Secretary presented for the Museum some Baskets manufactured by the Aborigines of Tasmania from the strap-shaped leaves of certain Cyperaceous plants common on the sand-hills by the seashore, and used by them in their wild state for carrying shellfish and other edibles, together with articles of the toilet. Necklaces worn by Tasmanian Aborigines, and ingeniously prepared by them from a small and highly pearlaceous shell (a *turbine*,) common on our coasts, were also added to the Museum by Mr. Milligan.

The Secretary read a note from Mr. Walter Mantel, of New Zealand, expressive of his desire to aid in furthering the views of the Society.

The Secretary reported the presentation to the Society's Gardens, by Captain Goldsmith, of the Rattler, of two cases of valuable Exotic Plants; and that several cases of Tasmanian and Australian Plants had been forwarded by the same vessel to London.

The principle and construction of the Aneroid Barometer became the subject of conversation; in which Sir William Denison, Dr. Turnbull, E. P. Bedford, Esq., Dr. Butler, &c. took part.

Mr. Douglas proposed that measures be taken for bringing under the notice of the British public, at the Grand National Exhibition in London in 1851, the natural productions of this island; instancing, among other objects of interest and economical importance, its highly ornamental cabinet woods and valuable ship timbers—its gums, balsams and drugs, &c.

The meeting, after voting thanks for the various donations, broke up about 10 o'clock.

10TH APRIL.—Monthly evening meeting; Dr. Officer, one of the Vice-Presidents, in the chair.

The following gentlemen were ballotted for and duly elected into the Society:—Messrs. Thos. Dobson, of the High School; Michael Evans, of Macquarie-street; and the Rev. Francis Brownrigg, of St. George's, Hobart Town. Captain Collinson, R.E., was admitted on Rule XVIII.

Letters from His Excellency Sir George Grey; from the Hon. the Civil Secretary to Government, New Zealand; from Lieut. Lynd, Auckland, New Zealand; and from the Royal Asiatic Society of London, were read.

A letter was read from J. E. Bicheno, Esq., stating that His Excellency Sir William Denison had transmitted for presentation to the Society's Library three volumes, forwarded by the Under Secretary to the Government of Bengal, by order of the Hon. the Deputy Governor.

The Secretary reported the presentation by Sir William Denison to the Society's Gardens of a packet of seeds from Calcutta, containing one hundred and eight species; the receipt of one hundred and four species of seeds indigenous to New South Wales, from E. M. Bowman, Esq., of Camden; also the presentation of a case containing thirty-two New Zealand plants, by A. Hort, Esq.

Twenty-four coins, ancient and modern, were received from Sir Henry Atkinson, R.N., for the Museum.

The Secretary read a note from Capt. Greenwood, 31st Regt., Brigade Major, Auckland, New Zealand, presenting a box of choice shells—marine, fresh water, and terrestrial.

The skin of a squirrel-like animal (*Acrobates Pygmæus* Desm.) of the size of a common mouse, from Port Albert, was received from Mr. H. Best.

A large specimen of prawn, and a fish (not named) were received from Mr. A. B. Jones, having been caught in the bay near his farm.

A note was read from Mr. A. Douglas presenting a case of dried plants indigenous to New South Wales, collected by Mr. Mossman; the egg of an Emu (*Dromiceius Novæ Holland,* Vieillot) from Gipps' Land; two eggs of the black swan (*Cygnus Atratus*) from Port Davey; with some shells, recent and fossil; the latter from Market Harborough, Leicestershire, England.

The Secretary reported the presentation from the Hon. Capt. Keppell, of H.M.S. *Meander*, of about fifty species of rare shells—marine, fresh water, and terrestrial—collected on the Chinese coasts, at Borneo, Labuan, New Ireland, and in the seas adjacent.

The presentation from Capt. Collinson of a number of samples of the timbers of New Zealand, of a size sufficiently large to admit of their density, hardness, and tenacity, as compared with the timbers of Van Diemen's Land, being thoroughly tested, was announced. These specimens of New Zealand timbers were accompanied with dried leaves of several of the trees yielding them, with memoranda by Capt. C., and additional notes by W. Swainson, F.R. and L.S., &c.

A letter was read from Lieut. Lynd giving an account of a New Zealand bird, allied to the Terns, about the size and having much the plumage and general appearance of the common sandpiper of the shores of Tasmania; but remarkable in having its rather long, acuminated bill turned to the right side, and slightly upwards.

A specimen of New Zealand coal, said to have been procured from beds of great thickness on the banks of a magnificent river in the Waikato district, forwarded for examination by Lieut. Lynd, was laid before the meeting: in structure, appearance, and qualities it resembled the jet-like mineral which is found in the bed of the Derwent, and more abundantly in the tertiary strata at Macquarie Harbour; like the latter, the New Zealand mineral is associated with iron Pyrites and with a fossil resin which Lieut. Lynd considers identical with that of the Kauri pine *(Dammara Australis)*. A note from Mr. Lynd, and the following letter* of the Rev. A. G. Purchas on this subject, published in the *New Zealander* newspaper of the 23rd February last, were read.

The Secretary read extracts from an article taken from the Edinburgh New Philosophical Journal for July, 1849, transmitted by D.A.C.G. Mitchell, on the occurrence of a peculiar manna in large quantities upon a scrubby variety of gum-tree *(Eucalyptus Dumosa)* at Port Phillip, known to the aborigines there under the name *Lerp* or *Laap*, and used by them as an article of food.

Mr. Milligan placed before the meeting leaves recently taken from a gum-tree near Oyster Cove, thickly covered with the little white patella-like forms characteristic of this substance.

The lately-invented harpoon gun, of which two specimens have been imported by Messrs. Nathan and Moses, of this city, was exhibited.

The thanks of the Society having been voted for the various donations, the business of the evening terminated.

* *To the Editor of the New Zealander.*

Sir,—Having occasion lately to spend a short time in the Waikato district, I took an opportunity of examining the localities in which coal has been found. A short account of what we saw may perhaps interest your readers.

Coal has been seen in four or five places on the banks of the Waikato River, in the great ridge of hills of which Taupiri is the most remarkable point. We visited three of these places,—two on the south and one on the north bank of the river. That on the north bank has been the longest known. Many years ago a large land-slip took place and uncovered the edge of a coal seam ; but it was not until within the last few years that the natives became acquainted with the nature or value of the treasure so disclosed.

The coal brought to Auckland for sale some time ago was from this place ; but, being taken from the exposed surface, may be considered as an unfavourable specimen.

At the time of our visit the quantity of clay washed down by the rains was so great that the seam was nearly covered. We succeeded, however, in exposing a few feet, and found the upper seam to be about 22 inches thick, of close, compact texture and brilliant fracture, covered by a good substance of dark brown shale, and bounded below by a much thicker *bed* of the same substance. In this lower bed of shale we were much interested by finding fine specimens of *kauri* gum, interspersed with small quantities of iron *pyrites*. We were unable, from want of time, to examine the lower stratum of coal ; but there is every reason to believe that it is of great depth, the shale appearing again about 20 feet further down the side of the hill. The situation of this place is nearly opposite the village of Kupakupa, and is from a quarter to half a mile from the edge of the river. The land belongs to the well-known old chief Te Whero Whero, of the tribe Nga-ti Mahuta.

The second place in which coal was discovered is on the south bank of the Waikato, a little higher up the stream. It is called Papahorohoro, and belongs to chiefs of the Nga-ti Mahuta tribe. The seam of coal was first seen by some natives who were digging for *kauri* gum in a little gulley about half-way up one of the hills that bound the narrow valley through which the river flows. At the time of our first visit, a very small portion of the seam had been removed; but sufficient was visible to lead us to think it worth a careful examination. There was not a pickaxe to be obtained in the whole district—we were, therefore, forced to content ourselves with a mortising axe, some spades and hoes; armed with these, we commenced our labours, and before evening had the satisfaction of uncovering the seam to the extent of about 15 feet in depth, without reaching its lower edge. We also uncovered its upper surface for some distance, and separated about half a ton of coal. I have the pleasure of forwarding to you a specimen of the coal from this place. It is of a compact kind, having a brilliant conchoidal fracture; and, although burning with a brilliant flame, is very durable. A sufficient quantity for trying its quality has been used to-day by Mr. Watson, blacksmith, of High-street, Auckland, and found to be *too good* for smith's purposes; that is, having too much flame. For domestic purposes and as fuel for steam boilers, it is said to be superior to New South Wales coal, being clean, and perfectly free from sulphur. In appearance it closely resembles the cannel coal of England, but differs from it in not being so easily lighted.

The other place visited is a little higher still, on the same side of the river, and, as far as I am aware, was only known to the native chief who was my guide. It has, I believe, no distinguishing name. The seam was exposed by a land-slip, and is very large; but from the hastiness of our visit, it was impossible to make more than a superficial examination. The portion uncovered was probably about 25 feet in width, and from 18 to 20 feet in depth; but the middle of this is now covered by a new slip of earth, with shrubs, toe-toe, &c. growing upon it. Sufficient, however, is visible to show the great extent of the bed.

Both of these mines might be worked with the greatest ease, and, for the present at least, would require no machinery. They are situated at a considerable elevation above the river, thus affording a facility for drainage without the use of pumps. The distance from the river's side is only a few hundred yards, with a gradual slope the whole way.

There is water communication by the river Waikato and the little streamlet of the Awaroa to within three miles of Waiuku, upon the Manukau harbour, and then across the harbour to Onehunga. The portage from the Awaroa to Waiuku is very good even in its present natural state, and with a very little judiciously-employed labour might be made an excellent road.

Trusting that some means may speedily be found of turning this store of fuel to good account, to the advantage of both the natives and our fellow-colonists,

I remain, your very obedient servant,

Arthur G. Purchas.

22nd February, 1850.

8th May.—Monthly evening meeting, numerously attended; His Excellency Sir William Denison, President of the Society, occupied the chair.

Alfred Denison, Esq., of Sydney, was ballotted for and duly elected a Fellow of the Society. W. R. Pugh, Esq., M.D., of Launceston, has been admitted on Rule xvii. The Secretary presented a copy of Ross's Hobart Town Almanack for 1832 from the Messrs. Best.

Mr. Phineas Moss presented three books, namely, Dr. Drummond's "Letters to a Young Naturalist," "Synopsis of the Contents of the British Museum," and "A Grammar and Vocabulary of the Aboriginal Language of South Australia."

Mr. Milligan presented seven quarterly parts of the "Transactions of the Highland and Agricultural Society of Scotland."

The receipt at the Society's Gardens of two cases from England containing choice *Camellias* and other plants, generally in good condition, was reported; also the receipt of a case from Joseph Bonney, Esq., of Perth, containing eighty plants, chiefly Australian; it was also stated that Mr. Newman had forwarded to the Botanic Garden at Sydney, per H.M.S. *Meander*, a large case of plants and scions, together with two boxes of choice strawberries.

Mr. A. Makeig, of the Treasury, placed on the table a large and elaborately-finished model of Chapman's Patent Drop Machine, by which coal is lowered in the trucks to a ship lying in deep water, and poured into the hold in a way to avoid breakage, at the rate of 2 to 3 tons per minute. The examination of the various details of this beautifully executed and valuable model, and the exhibition of its mode of operation, created general interest and attention.

The Secretary placed on the table a box of geological specimens collected by Mr. James Scott, Surveyor, Launceston, on the northern side of the island, transmitted by him to the Surveyor-General, and by order of Sir William Denison transferred to the Society's Museum. His Excellency the President took the opportunity of stating that orders have been given to observe and collect rock specimens and minerals, and carefully to note their localities and connections, so far as may be practicable, in the progress of the trigonometrical survey, so as to get together data for the preparation of a geological map of the colony.

A sample of New Zealand coal was presented from Mr. Lewis, of Collins-street.

A beautiful impression of *Osteolepis* from the Devonian Rocks, at the Orkneys, north of Scotland, was presented by Henry D'Arch, Esq.

Mr. Milligan placed on the table specimens (male and female) of *brachyurous* Crustaceans (Crabs), from D'Entrecasteaux Channel; one pair belonging to the *Oxyrhynchi* (of Milne Edwards), and the other remarkable for the possession of ciliated antennæ, with a rim having a fine steel-blue tint; specimens from a bed of Lignite, near "Beckford's," on the Tamar River—of the soft argillaceous cliff reposing upon it—and of ferruginised roots, &c.;—also a section (dressed and French-polished) of the stem of the graceful palm-like Richea (*Richea pandanifolia*), found in the dense forests between Lake St. Clair and Macquarie Harbour, where it attains the height of 40 to 50 feet in sheltered positions,—the venation, markings, and rich yellow colouring of which were much admired.

A paper upon the bituminous coal which occurs on the Australian coast, between Western Port and Wilson's Promontory, near Cape Liptrap, by Mr. G. H. Wathen, was read.

Mr. Dobson, of the High School of Hobart Town, submitted some carefully-executed coloured drawings of an insect whose labours in the formation of a small conical domicile or chrysalis on the leaf of the white gum-tree, and its metamorphoses therein, have been recently very closely observed by him in reference to the paper which was read before the Society at last meeting, on the *Laap* or *Lerp* found on the *Eucalyptus Dumosa* over extensive tracts of country in Australia Felix at certain times.

A paper of Captain Collinson's, on New Zealand timbers, was postponed on account of the lateness of the hour. The thanks of the Society were voted for the numerous donations, and in a special manner to Mr. Makeig for his masterly model. The meeting broke up a little before ten o'clock.

12TH JUNE.—Monthly evening meeting; Robert Officer, Esq., one of the Vice-Presidents, in the chair.

Mr. Francis Cotton, of Kelvedon, Swan Port, and Mr. Salier, of Liverpool-street, Hobart Town, were ballotted for and duly elected. The Rev. W. B. Clarke, M.A. F.G.S. of Sydney, and the Rev. Chas. Pleydell N. Wilton, M.A., of Newcastle, N. S. W., both members of the Tasmanian Society, were proposed and admitted on Rule XVII.

Dr. Henry Butler presented to the library of the Society, in the name of the author, Mr. Field, of Isleworth, two volumes on Analogical Philosophy.

Mr. Phineas Moss presented a small volume on Taxidermy, with manuscript notes.

A fragment of compact blue limestone, obtained by one of the Government Surveyors in the bed of the Florentine River, (a tributary of the Derwent, on its western side, and nearly opposite to Marlborough), where it is said to occur over an extensive tract of country, was sent to the meeting by His Excellency Sir W. Denison.

Specimens of clay-ironstone and fossils, from the carboniferous strata at St. Paul's Plains, were received from F. W. Stieglitz, Esq., of Lewis Hill.

Major Last laid on the table specimens of schistose clay, &c., having beautiful impressions of *Glossopteris Browniana*, obtained at "Nobby Island," near the mouth of the Hunter River, New South Wales, during the construction of the breakwater at Newcastle.

G. T. W. B. Boyes, Esq., sent for the museum two old English silver coins, respectively of the reigns of William the Conqueror and of Edward the First. That of William the First belongs to a box containing 6500 pieces or more, accidentally found by four little boys playing marbles in a piece of pasture-land called "Old Litten," near the manor-house of Beaworth, in Hampshire, on the property of Mr. Dunn, of Aylresford, on Sunday, June 30, 1833. This box of treasure was exposed and broken open by the wheel of a heavy waggon cutting deeply into the ground.*

James Barnard, Esq., presented to the museum preparations of a black snake, and of a lizard, of the colony; also autographs of the poets Wordsworth, Southey, Moore, James Montgomery, and Joanna Baillie,—of James, the novelist and historian; Cooper, the American novelist; Dr. Elliotson, Sir Charles Lyell, and M'Culloch, the political economist.

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* Ruding's Annals (4to.) of the Coinage of Great Britain, vol. i. page 151.

From Morton Allport, Esq., two drawers full of Tasmanian insects, well preserved, were received; many of them reared from the egg by Mr. A. A fish, probably *(Chironectes)* undescribed, having a remarkable elbow-joint-like conformation of pectoral fins, was presented by Mr. Allport.

C. C. Abbott, Esq., of the 18th Royal Irish, presented to the Museum a handsome collection of heads and horns of the Antelope and Deer tribes frequenting the rocky sides and summits of the lower ranges of the Himmalay Mountains.

P. S. Tomlins, Esq., forwarded to the meeting a spirit preparation of a curious specimen of the *Tunicata.* The animal looks like a free member of the genus *Accidia* on its proper surface; but underneath, and in the spaces between three leathery pendant flaps, there is on one side loose *Branchiæ,* and on the other, covered by a soft membrane, a thin and pellucid shield-like shell. It will probably be found to be a link between this class of animals and the conchiferous *Molluscæ.* The specimen was procured by Mr. Tomlins on the sea-beach at South Port.

H. Hull, Esq., placed on the table some fragments of granite, compact quartz, quartz rock veined with iron, recently collected by him on Ben Lomond; also specimens of the fresh-water muscle *Unio,* from the South Esk; and a good specimen of a hermit or soldier crab, in his usurped shell—a *Fasciolaria.*

Mr. Milligan placed on the table spirit preparations of the diamond snake and whip snake of the colony—the former taken at Circular Head, the latter on Flinder's Island; also specimens of the egg of a member of the shark tribe, known as "Sea Purses:" on examination, one was quite fresh, the yolk and white being distinct, without appearance of vivification. They were taken by a fisherman, according to his own account, from a short squat fish, which he calls a "Nurse," and which he says was afterwards thrown into the water.

On the table lay a fine specimen of *Sagus Ruffia* in fruit, and the large seed vessel of the *Lodoicea Sechellarum.*

Dr. Crooke presented in a phial, from Mr. Weston of Adelaide, a sample of washed gold-dust from the Onkaparinga district, South Australia.

The Secretary reported having forwarded to the Museum at Sydney a quantity of skins of birds of Tasmania—that the Horticultural Society of London had acknowledged a large assortment of indigenous seeds sent to them by the *Marmion*—and that the Society's "Papers and Proceedings" had been acknowledged by the British Museum, the Royal Institution of London, the Australian Subscription Library, &c.

A note from Colonel Bolton, R.E., was read.

The Secretary read a paper from D.A.C.G. Mitchell on Mimosa bark, and the two following notes to Capt. Chalmers of Bagdad; also from Dr. M'Kenzie of Kinellan, near Dingwall, Ross-shire, Scotland, on the introduction of salmon into Tasmania.

" *Kinellan, by Dingwall, 2nd July*, 1841.

" Sir,—In Sir F.'s absence I hasten to reply to your favour of 28th ultimo.

" I could not supply you with young fry, because they would have to be carted 80 miles to the steamer at Inverness; and if they survived this, I fear they might, through neglect, die before the *Queen of Scotland* reached London. If you choose to send down a person to take charge of them with a proper vessel or two, I will supply you with a lot of fry. The expense will not be serious by steamer from Hore's Wharf to Inverness on the 12th. I would have a cart ready for him, to send him to, and bring him back from, the west coast, where the fry are. But you must write me directly. Allow me to suggest a better and simple plan, and I think one that cannot miscarry. We take the roe and melt from a fresh-killed fish—say in September,—rub them together, deposit the roe in a basket of fine gravel in a pool, and in March or April the fry come out in swarms. Why should not you (or some one you can recommend to me) take out a supply of roe thus prepared, plunged in your tank? I am perfectly certain, that if shipped in September or October, and deposited in a river in Australia before March, 99 of the 100 grains of roe will become salmon. Let me hear from you.—Yours truly,

" J. Mackenzie, M.D.

" Captain Chalmers."

" *Kinellan, by Dingwall, 12th July*, 1841.

" Dear Sir,—I fear you will hardly get a roe and melt so far advanced by 1st August as to be depended on for impregnation. But by consulting some of the Billingsgate folks you may perhaps succeed; at all events it is worth trying, as the cost will be almost nothing. A common basket, with cover, filled with gravel and roe impregnated, and sunk in your tank, will require no more trouble till you land in Australia, when the basket can be put into a pail and carried to any stream where you wish to try if the thing is to succeed.

" Next year (D.V.) you can have some fry sent south to you in better time if you like; or if you will give me the address of some careful confidential friend, I will send him south two baskets, containing impregnated roe, say in September; one basket to be sunk in water in England to produce live fish for your next year's trip,—and the other to be shipped to your address in Australia, where it is probable you will receive it long before the fry begins to chip the shell.

"All that will be necessary is to direct your friend to keep the basket under water in some *fresh* stream till the ship is ready to sail, when one can be transferred to the ship tank, and the other remain (in a pure running stream if possible) till the fry begin to emerge in March, when a pool can be formed surrounded with a fine net to prevent their straying and being destroyed. Let me hear from you as to this before you start.—Yours faithfully,

"J. MACKENZIE, M.D.

"Captain Chalmers."

Dr. Officer expressed doubts whether the temperature of the rivers of Tasmania is sufficiently low in the winter for salmon to thrive in.

Mr. James Burnett remarked, that it has been considered essential to the successful introduction of the fertilised roe, that it should be placed during the passage out in a current of fresh water.

Dr. Butler cited experiments of Professor Owen to show that the roe and milt, taken at the proper season, mixed, and then deposited together in a tub of standing water and kept there, become hatched about the usual time and yield fry in abundance, and that the introduction of the fish may prove much easier than anticipated.

Dr. Officer thought we might yet, perchance, find it most convenient to procure the salmon from California.

The Secretary read a letter from J. E. Bicheno, Esq., F.R.S., &c., on a specimen of saw-fish, *Pristis Cirratus.*

Mr. D.A.C.G. Mitchell gave a short but clear and satisfactory exposition of a new mode of setting up the rigging of vessels, illustrated by a neat model which he placed on the table. The contrivance has a light and elegant appearance, and is considered in an especial manner applicable to merchant vessels, as it is calculated to effect a material saving in manual labour.

After discussions on various matters before the meeting—in which Mr. James Burnett, Drs. Agnew and Butler, Lieut. Smith, Major Last, and others joined,—it was moved by Joseph Hone, Esq., seconded by Dr. Turnbull, and carried, "That the thanks of the Society be given to the persons who have made presentations and furnished papers."

The meeting broke up a little before ten o'clock.

10TH JULY.—Monthly evening meeting; the chair taken at half-past seven by His Excellency Sir W. T. Denison, F.R.S., &c. &c., President. The following gentlemen were elected into the Society:—Thomas Anstey, Esq., of Anstey Barton; Lieut. Walker, R.N., of Launceston.

The Secretary drew attention to a choice collection of *Algæ* made at George Town by the Rev. J. Fereday—to a sample of bituminous coal dredged up in the River Tamar below Whirlpool Reach—and to a specimen of timber possessing a perfume almost equal to that of sandal-wood, a section, apparently, of a small *Acacia* not identified, but said to occur at or near George Town; presented to the Society's Museum by Sir Wm. Denison.

A cabinet of mineral and rock specimens from Europe, arranged and numbered, with a catalogue, presented by John Abbott, Esq..

A sample of coal from the lower seam at the Schouten Island, received from Mr. Whitcomb, lay upon the table.

Lieut. Smith, R.N., presented a collection of mineral specimens of great interest from South Shetland, Kerguelen's Island, Ascension, St. Domingo, Greenland, Cornwall in England, &c.

Mr. Hull presented to the Museum, in the name of James Mackay, Esq., upwards of a hundred curious coins, ancient and modern; together with a few sea shells.

The Secretary reported that two cases of Australian plants and a packet of seeds have been received at the Society's gardens, presented by Sir W. Denison; that a packet containing twenty-five species of Australian seeds has been received from Mr. R. Officer of Port Phillip, through the kindness of Dr. Officer; and that fifty species of seeds have been forwarded to J. Bonney, Esq., of Perth, in exchange for plants and seeds received at sundry times. A specimen of the *Ardea Novæ Hollandiæ*, or heron, commonly called a crane in the colony, was presented by G. T. W. B. Boyes, Esq.; the bird was shot on the banks of the Derwent, near Mr. Boyes's residence, at New Town.

Joseph Allport, Esq., forwarded for the Society's Museum the skin of a Tasmanian eagle, the *Aquila fucosa*.

E. Hathaway, Esq., United States Consul, presented a sample of anthracite from Pennsylvania, of which a fire in the ante-room was made: as a fuel it is remarkable for entire freedom from smoke and flame, and it is of a character so durable that a fire properly made up will last more than twenty-four hours.

A good specimen of goldbeater's skin, with a jar of gold leaf, manufactured by Mr. R. V. Hood from Californian gold with tools made in Hobart Town, was presented to the Society's Museum by Mr. Hood.

Mr. Milligan placed on the table some preparations in spirit of Tasmanian fishes; also some curious fossil forms recently discovered by him in certain clayey beds under sandstone strata in D'Entrecasteaux Channel; they are in shape *trilobite*, from one to five or six inches in length—in some instances two inches in breadth. The *carapace* and heads are yet desiderata. This fossil from D'Entrecasteaux's Channel approaches closest to the *Calymene* in general appearance of any of the families of the tribe which have been figured; casts of the stems of *Algæ* and a form like *Orthoceratite* are associated.

The Secretary read a communication from Mr. Edwin Ward Trent, of Park Rope Manufactory, Essex, recommending the introduction of Italian hemp into Van Diemen's Land, as calculated to become a valuable staple, realizing in England £30 to £50 per ton. Mr. Trent states that he has discovered a mode of dressing New Zealand flax at a rate not exceeding 2*s*. per cwt.

The Secretary read the following communication from Francis Cotton, Esq., of Kelvedon, Swan Port, on the habits, &c. of Snakes of Tasmania; Dr. Agnew, Lieut. Smith, and others adduced facts to corroborate the statements of Mr. Cotton:—

"To Dr. Milligan,

"Respected Friend,—I herewith send my promised account of Snakes, and regret that I cannot, as thou wilt perceive, enrich it with some anecdotes by the writer of the letter which I enclose.

"I have seen much more of snakes in this than in the old country, and have noticed circumstances here which may or may not be common there. For instance, some of our cats seem to have a predilection for the small snakes; they sometimes bring them up to the house,* play with them, and finish by eating them as they do mice. The fur of the cat seems to protect it against snake bites; for I understand that every effort has been tried, but fruitlessly, to make the snake bite this animal. The opossum enjoys, I apprehend, a similar immunity. Eagles and hawks devour snakes, and have been frequently observed soaring with them in their talons to a considerable height in the air, whence they drop them to the ground in order to kill them; and when they fail to accomplish this on a first effort they repeat the process, and conclude by eating them.

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* Lieut. Smith remarked that he had seen a cat bring a whip snake into the parlour in Capt. Read's house, at New Town.

"Snakes are amphibious. A diamond snake, pursued by one of my sons, took refuge in a shallow water-hole, and upon search being made in order to despatch it the reptile was found coiled up in the gravel at the bottom.*

"Some years ago I lost a shepherd from a bite in the wrist by a black snake, which he was in the act of striking with a short stick. The man walked to the edge of the bay, and washed the wound in salt water; but no attempt was made at excision, on account of the sinews and artery. The man was bit about noon; my son saw him about half-an-hour after, and there being no medical man nearer than 20 miles he sucked the wound, remaining with him till 8 o'clock in the evening, when he left under the impression that the man would recover; but he died about 3 or 4 o'clock next morning, apparently from general paralysis.

"A few months ago my friend Dr. Story saw a snake in the garden of the "Grange" Estate, Great Swan Port, and looked about for a stick to kill it with; on returning he was surprised to find the reptile still in the same place, and that it appeared to be somewhat torpid. The snake was readily dispatched, when it became apparent that it had been killed in the act of swallowing something which, on a closer inspection, proved to be another snake, about four inches of the tail of which protruded from its jaws.

"I visited the "Grange" on the following day, when Dr. Story showed me the snake as he had killed it; after which the half-swallowed snake was withdrawn,—an operation requiring considerable force. We measured the snakes, and found that one, which was of the red or diamond species, was about 31 in. in length; while the other, which was a young black snake, measured 22 in. only. The diamond snake was probably full-grown, being thick in proportion to its length; the black snake was about half the bulk of the other.

"As neither Dr. Story nor myself had before seen snakes in like circumstances, or heard of such having been observed by others, we supposed it to be a discovery that snakes preyed on each other; and also that this might account in some measure for their comparative fewness throughout the island. Of the former supposition I was soon undeceived; for, meeting with Charles Meredith, I related to him what we had witnessed, when he told me that he had *twice* before heard of such occurrences,—one at a sheep station on the Morumbidgee River, New South Wales; the other in the neighbourhood of Port Sorell, where for some time he held the appointment of Assistant Police Magistrate.

"That snakes climb trees with ease is well ascertained, though it seems almost incredible when the tree is upright and the bark smooth, as in the white gum. One of my sons, some years ago, passing a tree of this description without a branch for twelve feet up, saw a black snake fall therefrom to the ground; he killed it, and on cutting it open found in it several young parrots. He then climbed the tree with some difficulty, and found among the branches an empty parrot's nest, the occupants of which had no doubt furnished the snake with a meal.

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* Mr. Milligan remarked that he had seen a large black snake in the Tamar river, about 1½ miles below Launceston, swimming directly across the wake of a vessel, and where the water was of course brackish, if not quite salt.

"About twelve months ago, three of my sons on one of their play afternoons were in the bush, and seeing an opossum hole in a tree (about four feet in thickness, the first branch being about seven feet from the ground), one of them climbed up to see if the hole were occupied, and on looking in saw an opossum moving about, instead of sitting perfectly quiescent as they usually do; he then made a noise, when the animal looked up, and as my son leaned back to break off a stick, jumped out and ran away along the ground, pursued by the children. The opossum soon climbed a small she-oak tree, where he was immediately shot. On going to take him up, a red snake was seen entwined round his neck, the head hidden or buried in the fur. The snake was about 30 inches long, and had two turns or coils round the opossum's neck; it was of course killed.

"Here are instances of two species of snakes climbing trees*—the first evidently on a predatory excursion; the last possibly on the same errand.

"It is not unlikely that other persons may be able to communicate facts similar to those I have detailed; but whether such be the case or not, it seemed to me that the relation might prove interesting to many persons, and perhaps induce others to be more observant of the habits of a class of reptiles justly held in general abhorrence.

"I remain, thy friend,

(Signed) "FRANCIS COTTON.

"Kelvedon, Great Swan Port,
12th of 6th month, 1850."

In connection with this subject the Secretary laid on the table the following statement of experiments made by Dr. Dawson, D.I.G.H., and Staff-Surgeon Huish, in presence of other medical men, in order to test the efficacy of a preparation alleged by Charles Underwood to be an antidote to the poison of Snake bites, on the 13th, 14th, and 19th February, 1850:—

"Two cats and twenty-three dogs, in all twenty-five animals, were bitten by black, brown, and diamond snakes. To fourteen, Underwood applied his preparation, and four of them died. The other eleven were tied up without anything being done to counteract the effect of the bite, and three of them died; or 28½ per cent. died after the application of the antidote, and 27⅓ per cent. without the antidote.

"Excepting in one case the snakes would not voluntarily bite; the exception was in the case of one of the cats, which died. The methods adopted to make the snakes bite were, first, by confining one snake after another in a large wire cage, and throwing dogs, cats, and rabbits in on them: this failing, one snake at a time was allowed to be free on a grassplot, and animals were dragged over it in every way. This, likewise, failing to excite the snakes to attack or bite any animal, Underwood seized the snake behind the head, the mouth was forced open, and if its poison-fang appeared perfect, the tip of the dog's nose or the inside of a dog's ear, where the small blood-vessels are numerous, was placed within the jaws of the snake: in some instances the snake fixed itself; in the others it appeared to be forced by Underwood to bite. In every instance there was the mark of a bite, and when the antidote was used it was immediately applied."

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* Dr. Agnew stated that in the vicinity of Sydney he had shot a snake upon the limb of a tree at least 30 feet from the ground.

Feb. 12.—A puppy was bitten by a small black snake, no antidote was applied, and the animal lives.

Feb. 12.—A cat was bitten by a large diamond snake at 2h 7m, antidote applied, died at 6h 15m.

Feb. 12.—A cat bitten by a large diamond snake at 2h 10m, no antidote applied, died at 3h 20m.

Feb. 12.—A cat bitten by large black snake at 2h 25m, no antidote applied, died at 2h 35m.

Feb. 12.—Dog bitten by a large black snake at 2h 36m, antidote applied, died at 3h 15m.

Feb. 13.—Dog bitten by a large black snake at 1h 44m, antidote applied, lives.

Feb. 13.—Dog bitten by a large black snake at 1h 46m, antidote applied, died at 6 a.m. on 14th.

Feb. 13.—Pup bitten by a large black snake at 1h 52m, no antidote applied, died at 7 p.m.

Feb. 13.—Dog bitten by a large brown flat snake at 1h 56m, antidote applied, lives.

Feb. 13.—Dog bitten by a large brown flat snake at 1h 58m, antidote applied, alive.

Feb. 13.—Dog bitten by a large brown flat snake at 2h 35m, antidote applied, alive.

Feb. 13.—Dog bitten by a lage diamond snake at 3h. 45m, antidote applied, alive.

Feb. 13.—Dog bitten by a large diamond snake at 3h 50m, antidote applied, alive.

Feb. 13.—Dog bitten by a large diamond snake at 3h 55m, no antidote applied, alive.

Feb. 14.—Dog bitten by a large brown snake at 12h, no antidote applied, alive.

Feb. 14.—Dog bitten by a large brown snake at 12h 1m, antidote applied, died at 7h 30m.

Feb. 14.—Dog bitten by a large orange diamond snake at 12h 10m, no antidote applied, alive.

Feb. 19.—Dog bitten by a large black snake at 11h 53m, antidote applied. All the following animals were alive on the 20th at 6 p.m.

Feb. 19.—Dog bitten by a large black snake at 11h 55m, no antidote applied, alive.

Feb. 19.—Dog bitten by a large black snake at 12h, antidote applied, alive.

Feb. 19.—Dog bitten by a large black snake at 12h 2m, no antidote applied, alive.

Feb. 19.—Dog bitten by a large brown snake at 12h 10m, antidote applied, alive.

Feb. 19.—Dog bitten by a large brown snake at 12h 13m, no antidote applied, alive.

Feb. 19.—Dog bitten by a brown snake (about 2½ feet) at 12h 17m, antidote applied, alive.

Feb. 19.—Dog bitten by a black snake at 12h 19m, no antidote applied, alive.

(Signed) Wm. Dawson,

Deputy Inspector-General of Hospitals.

Results of further Experiments made on the 23*rd and* 26*th Feb.,* 1850.

Feb. 23.—Pointer dog bitten by a large black snake 12h 15m, antidote applied, alive.

Feb. 23.—Small dog bitten by a large black snake 12h 15m, no antidote, died at 11 a.m. on 25th instant.

Feb. 23.—Dog bitten by a large black snake 12h 30m, antidote applied, alive.

Feb. 23.—Dog bitten by a large black snake 12h 35m, antidote applied, alive.

Feb. 23.—Dog bitten by a large black snake (second time) 24m to 1 p.m., no antidote, alive.

Feb. 23.—Dog bitten by a large black snake, 20m to 1 p.m., no antidote, alive.

Feb. 23.—Dog bitten by a large black snake 5m to 1 p.m., no antidote, died at half-past 10 p.m., 23rd instant.

Feb. 26.—Dog bitten by a large black snake 6m to 12, antidote applied, alive.

Feb. 26.—Black and white spaniel bitten by a black flat snake, 12h 6m, no antidote, died during the night of the 26th.

Feb. 26.—Puppy bitten by a whip snake 12h 15m, antidote applied, unknown. Lost by Underwood on his way home.

Feb. 26.—Dog bitten by a green whip snake 12h 15m, no antidote, alive.

Feb. 26.—Dog bitten by a whip snake 12h 21m, antidote applied, alive.

Feb. 26.—Small black dog bitten by a large black snake 12h 25m, antidote applied, alive.

Feb. 26.—Black dog bitten by a large black snake, 12h 30m, no antidote, alive.

Feb. 26.—Pointer bitten by a large black snake 26m to 1, antidote applied, alive on 26th at 50m to 2, but has lost the use of its limbs.

H. Huish,

Assistant Surgeon to the Forces.

A paper by Capt. Collinson, R.E., upon the timbers and timber trees of New Zealand, was read, which led to animated and interesting conversations; in which Mr. Ronald Gunn, Mr. D'Arch, Lieut. Clarke, Sir William Denison, and other gentlemen joined. Major Last remarked that it is chiefly, if not exclusively, under and above the roots of the *Rata (Metrosideros robusta)* that the plant caterpillar, *Sphœria Robertsia*, is met with.

The thanks of the Society having been unanimously voted to the various persons who had made donations, the President left the chair, and the meeting broke up soon after 10 o'clock.

14th August.—Monthly evening meeting; J. W. Agnew, Esq., M.D., in the chair.

The Rev. David Boyd, of Norfolk Plains, was ballotted for and elected a member.

On the table was a fine stuffed specimen of the bittern of Tasmania (*Botaurus Australis*), presented to the Museum by Alban C. Stonor, Esq., Solicitor-General.

Mr. Ring presented samples of the gold-dust of California in its washed state.

A specimen of crystalized quartz, from Mount Picton, on the western side of the upper portion of the Huon River, was received from Major Cotton.

Dr. Officer presented a stuffed specimen of *Ornithorynchus paradoxus.*

Some choice apple and pear trees have been received from Mr. Fry, of Launceston, in exchange for scions sent to him from the Society's Gardens. A case has been forwarded to England, per *Eliza*, by the Superintendent of the Society's Gardens, containing *coniferæ* of New South Wales and Van Diemen's Land, *Richeæ* and *Treeferns.*

A note from Mr. H. Hull, transmitting to the Museum of the Society twelve small coins of silver, copper, and brass—amongst them a brass farthing of George II., was read.

The Secretary placed on the table for the Museum specimens of fossil woods, upwards of twenty in number, from various parts of Van Diemen's Land and Bass's Straits, duplicates of which have been recently forwarded to the British Museum, and to Mr. Brown, President of the Linnean Society, &c. Mr. Milligan also presented about 60 species of shells of Tasmania,—terrestrial, fresh water, and marine,—several possessed of much delicacy and beauty, and probably undescribed; duplicates of them have been forwarded to the British Museum. Mr. Milligan also presented for the Museum a human *cranium*, apparently aboriginal, and recently ploughed up on new ground near Wabbs' Harbour, in a tolerable state of preservation. It is known that the aboriginal tribes differed in their mode of disposal of the dead; some interred and roughly covered them over in holes and cavities accidentally formed by the upset of a tree or the like; others burnt their bodies to ashes in huge fires; while others, after placing them in hollow trees in a sitting position, surrounded them with loose pieces of dry timber, and so abandoned them.

Mr. Milligan also submitted specimens of granite, containing garnet, from Wabbs' Harbour.

The Secretary read letters from the Horticultural Society at Wellington, New Zealand, expressive of their desire to reciprocate; and from the principal librarian of the British Museum, communicating the intention of the trustees to furnish the Royal Society of Van Diemen's Land with copies of their extensive and valuable catalogues, and thanking this Society for specimens of *Gorgoniæ* sent home by the Secretary—the first of the kind met with in the southern hemisphere. The Secretary read extracts of an interesting letter from J. E. Gray, Esq., F.R.S. of the British Museum, on this and other corallines forwarded. Mr. Gray refers the coralline in question to *Primnoa*, of which he thinks it may form a *subgenus*, if it do not turn out to be an entirely new *genus*.

A communication forwarded through J. E. Bicheno, Esq., from Mr. Frederick Maning, on an unusual optical phenomenon, described by him as having occurred off Maria Island, during his residence near Spring Bay, was read.

The Secretary mentioned his having observed the appearance of luminous rays emanating from the shadow of a person thrown across a field soon after sunrise, at Sandy Bay, on a fine dewy morning. Attention was drawn to a small gun harpoon, neatly executed by D.A.C.G. Mitchell, on a principle suggested, it appears, by Staff

Surgeon Dr. Huish, of this city. The chief difference between this model and the gun harpoons from England is, that the line in this is attached to a nut, which, travelling along the harpoon itself, half enters the muzzle of the gun, into which it nicely fits.

A letter from Mr. Young, of Invershin, Inverness-shire, addressed to James Burnett, Esq., of this city, and recently received, on the introduction of salmon, was read. Mr. Young has had communications with Mr. B. Hawes on the subject, and he now recommends, as ensuring all but absolute success, that full-grown salmon should be sent out in a vessel fitted up for the express purpose, which he terms a *welled smack*. The cost, estimated at about £700 or £800, offers for the present an obstacle scarcely to be overcome; but it is expected that the more practicable and cheaper mode of bringing out spawn or smolt in tanks will be tried, and that the pleasures and profits of salmon fishing may in due course be added to the sports and pastimes as well as industrial resources of the colony.

Discussions followed, and protracted the sitting to ten o'clock, when, after voting the thanks of the Society for the various donations, the members separated.

11TH SEPTEMBER.—Monthly evening meeting; Joseph Hone, Esq., senior member of council present, in the chair.

The following gentlemen were ballotted for and duly elected into the Society:—Hon. R. G. Talbot, of Malahide; George King, Esq., R.N., Port Officer; John Mackinnon, Esq., of Selma; and Richard Cleburne, Esq., Hobart Town.

The Secretary reported the following donations to the Society's Library:—From John Abbott, Esq., a copy of Andrew Bent's Van Diemen's Land Almanack for 1824, said to be the first book printed and published in the colony; from Ronald C. Gunn, Esq., a copy of Sir W. J. Hooker's "Popular Guide to the Royal Botanic Gardens at Kew;" from Alfred Douglass, Esq., of Port Phillip, a treatise on "Mesmerism and Clairvoyance," recently published in Melbourne.

The presentations to the Museum were:—

A fine specimen of fossil wood (*Banksia?*) known as the *Ross fossil*, from J. E. Bicheno, Esq.

A valuable collection of eggs of Tasmanian birds, from Mr. Morton Allport.

A specimen of fibrous *schorl*, locality not named, from Mr. Barnard.

A collection of upwards of 30 marine and fresh water shells, comprising good specimens of the following genera—*Cypræa*, *Hippopus*, *Pinna*, *Pyrula*, *Natica*, *Ovula*, *Conus*, *Mitra*, *Cyclostoma*, and *Ampularia*, from Mr. John Abbott.

Two fragments of copper ore from Sir Henry Atkinson.

Seventy copper coins of ancient Rome, modern Italy, and other countries, from Mr. William Abbott.

A mass of siliceous matter, replete with impressions of Ferns (*Pecopteris Odontopteroides*, as figured by Strzelecki), found at Broad Marsh, from Mr. Walch.

The Secretary reported two cases of plants, forwarded from the Society's Gardens, per *Munford*, to New Zealand, and one case forwarded per *Emma*, to Sydney, containing plants and scions of fruit trees, varieties of willows, strawberries, &c. &c., for Mr. Bowman, of Camden.

The Secretary placed upon the table two marine parasitical Isopodous Crustaceans (*Oniscides ?*—Latreille), obtained from the rock-cod and gurnard here ; also an imperfect shell of *Nautilus pompilius*, thrown up by the sea on the east coast of Van Diemen's Land—and it was remarked, that as a perfect specimen of the same was obtained at Flinders' Island some years ago amongst a vast number of shells of the paper nautilus (*Argonautus Argo*), cast ashore there at same time, it may fairly be set down as an occasional inhabitant of these seas.

Mr. Milligan also mentioned having recently discovered, in a ravine upon the east coast of the colony, an elegant-looking shrub, ranging from six to twelve feet in height, clothed with long digitate leaves, set opposite, and drooping at their extremities, and having its young shoots more or less hollow and filled with pith, like those of the *Sambucus*. The shrub exhibited neither flower nor fruit. It will, probably, be referred to the *Umbellales* of Lindley, and to the order *Araliaceæ*, a dwarfish member of which (*Panax Gunnii*) Mr. Milligan discovered in 1842 in the dense dark forests near the Franklin River. This new shrub promises to become an acquisition to our arboretums and pleasure-grounds, and ought to be introduced.

Thomas Dobson, Esq., of the High School, read a paper upon three varieties or sub-species of *Psylla*, which he terms *Psylla Eucalypti*,—insects which, in the larva state, have the faculty of elaborating from the juices of the gum-leaves on which they live a glutinous and saccharine fluid, whereof they construct for themselves little conical domiciles, more or less beset externally with filamentous matter, somewhat resembling that characteristic of the *Aphides*. Mr. Dobson placed before the meeting a series of carefully executed coloured drawings illustrative of the subject. Twigs and leaves of *Eucalyptus* were produced bearing myriads of the white cones, which are probably identical with those said to prevail so abundantly at certain seasons in Australia Felix—called Lerp, and eaten by the aborigines, —and which has been noticed in the Edinburgh Philosophical Journal for July, 1849, as a new species of *Mannà*, &c.

Mr. Milligan read the following note from the Rev. S. B. Windsor, Warden of the College, Bishopsbourne, giving results, in 1850, from the operation of *budding* rose-trees in 1849.

" *Christ's College, 9th September*, 1850.

" MY DEAR SIR,—I met with rather a remarkable fact the other day, which you may perhaps feel interested in knowing. Last November I budded several rose trees in the College garden, a good many of which took well and flowered that season: several did not, as I thought, take at all; of these last I cut away some, and left others as they were. To my surprise I find this spring that almost every one of those which I left have taken, and are now shooting healthily into leaf. I have been in the constant habit of budding for nearly twelve years; but never witnessed a like phenomenon. To what would you attribute this? Have any more practical gardeners ever met with it; or is it quite unprecedented; and has the early spring anything to do with producing it? A mild winter, I should say, it has not been. We have had very little rain, but some of the most severe frosts which I ever remember in this country since my arrival.—My dear Sir, faithfully yours,

"S. B. WINDSOR.

"Joseph Milligan, Esq."

After conversation on various topics before the meeting, thanks were unanimously accorded to Mr. Dobson for his interesting paper, and to the several parties bringing donations. The Chairman vacated his seat, and the meeting broke up about nine o'clock.

9TH OCTOBER.—Monthly evening meeting; the Rev. John Lillie, D.D., a Vice-President of the Society, in the chair.

The following gentlemen were balloted for and elected:—L. C. Stevenson, Esq., John Watson, Esq., of Hobart Town; Francis Evans, Esq., Launceston.

The following presentations were made to the Library:—In the name of Dr. Fitton, forwarded through Dr. Pugh of Launceston, a copy of Sir Henry De la Beche's Address to the Geological Society of London, at the Anniversary Meeting held on 16th February, 1849. *Fasciculi* of Proceedings of the Zoological Society of London, in continuation from May to December, 1848, with the Report read at the Annual Meeting held in April, 1849. Mr. Milligan presented a publication of 1672, entitled the Practice of Physic, in seventeen books, by

Nicholas Culpepper, Physitian and Astrologer,
Abdiah Cole, Doctor of Physic,
William Rowland, Physitian ;

chiefly a translation of the Works of Lazarus Riverius, Counsellor and Physitian to the King of France, &c.

Mr. M. Allport presented to the Museum a collection of eggs of English birds; also a box of eggs of birds of Tasmania, with a list of names.

His Excellency Sir W. Denison sent a specimen of the common *Hippocampus*, and a very fine specimen of the more rare variety named *Phyllopteryx*, by Swainson ; also a sample of bituminous coal obtained by Mr. J. Scott, Surveyor, Launceston, at the Ben Lomond Rivulet, on the western flank of Ben Lomond.

Samples of plumbago *(Graphite)*, obtained in the shaft lately opened on the estate of Creekton, Norfolk Plains, the property of Abraham Walker, Esq., in pursuit of the veins of *Galena* with *copper*, occurring in the limestone and slate there, were presented from Mr. Walker.

The Secretary drew attention to an unusually large crab upon the table—one of two said to have been taken recently by fishermen on the East Coast.

Mr. Milligan also placed upon the table a quantity of the red balsamic exudation of the grass-tree *(Xanthorrhœa Australis)* of Tasmania from Bass' Straits; exhibited its highly combustible qualities, and remarked that, from the very fragrant odour which it yields, it may be found useful in the preparation of pastiles, frankincense, &c.—that it has been used to produce a nankin dye, and that it seems capable of being turned to account as the basis of a varnish. Mr. M. also placed upon the table a cone of *Banksia serratifolia* from Rocky Cape, Bass' Straits,—the only locality in Van Diemen's Land in which it is found ; it forms a picturesque but not lofty tree, prevailing over an area of several miles along the coast upon a meagre soil of sand with peat.

From H. F. Anstey, Esq., were received fine specimens of mountain duck (*Casarca Tadornoides*), and of the native hen (*Tribonyx Mortieri*).

Samuel Moses, Esq., presented a large branched zoophite from the island of Wahoo, one of the Caroline group, having a minutely ramified horny axis, with but a very partial deposit of calcareous matter of a pale bluish white colour, extending from the base or pedicle along the principal branches.

Thomas Dobson, Esq., of the High School, presented a well-finished model in wood of a self-registering tide gauge by himself. A perpendicular to the float, which is enclosed in a wooden box, acting upon a pencil by means of a diagonal moving in a horizontal slide, describes the rise and fall of the water on the surface of a cylinder covered with paper, to which motion is given by a common Dutch clock, and which cylinder may be subdivided to represent hours and minutes of the day and night. Mr. Dobson obligingly promised to furnish to the Society a written exposition of the construction and mode of working the instrument, with a diagram.—[The meeting considered it desirable that tidal observations should be made at the various light-houses maintained by the colony, and at Port Arthur, and other distant points well adapted for obtaining results uninfluenced by long narrow channels, freshes from the mouths of large rivers, &c. It is understood that His Excellency Sir William Denison, President of the Society, is favourable to the scheme.]

From R. W. Fenwick, Esq., P.M., Hamilton, has been received a case containing twenty-five varieties of dahlia from England for the Society's gardens.

Two cases of plants have been forwarded per *John Souchay* to Mauritius for the Botanic garden there; and Capt. Fallenstein is commissioned to procure on return a number of Cape plants, &c. for this Society.

The Secretary read the following extracts from a report made in 1824, after survey of the west coast of Tasmania, by Mr. Hobbs, and now obligingly forwarded by James Gibson, Esq., of Circular Head, for examination :—

"Pieman's River is in latitude 41° 40' 13" S. The mouth of it is totally unfit to approach, even with a boat, from the very heavy swell that immediately runs in upon the bay; and, in fact, all along this coast there is as much sea in fine weather as there is on the east coast in a gale of wind. I was obliged to *carry* a boat into the river. I proceeded up 18 miles before I met anything to impede my progress, when I arrived at numerous falls, and hauled the boat over them: this is as far as any boat can go. The falls are 21 in number.

This river runs from a swampy plain, about Mount Hemskirk. Its banks abound with pine* of the very best quality, also with lightwood† and myrtle.‡ At some distance towards its source is a very high clear hill, from the top of which I had a full view of all the country around. Notwithstanding the dangerous entrance, it still is practicable to get timber there, should it become scarce at Macquarie Harbour. The land about is sterile, but not so much so as all to to the southward of it. Being anxious to know if such land did exist to the northward of this river as has been represented, I sent Carrott, accompanied by two men, to examine the land, and to travel as far as Cape Grim, whilst I proceeded along the coast with the boats.

"Near West Point, on the south side, there is a river in lat. 41 ° 3', similar to Pieman's River, with a bar, mouth, and an entrance equally dangerous. We carried the boat along the beach into the river, and then went up 15 miles to the Falls.

"The water, like that of Pieman's River, is deep and salt up to the first falls, even at this dry season.

"This river rises from the low country around Mount Norfolk. The timber here consists of very fine stringy bark, gums, &c., with a few lightwood trees. The soil is barren and little fit for any purpose, with exception of a few potatoes; nearly a mile inland there is a light sandy soil, covered with grass."

The Secretary read extracts from the Annals of Natural History, giving an account of a Tasmanian Cowry sent home by R. C. Gunn, Esq., described at a meeting of the Zoological Society of London by J. E. Grey, Esq., F.R.S., which sold for £30. Mr. Milligan exhibited a shell of the same description (but less perfect), obtained by him on the east coast of Flinders' Island.

The Secretary read a note from Mr. Gunn, stating that the *(Petaurus sciureus)* flying squirrel of Port Phillip has become naturalised in Tasmania.

Mr. Milligan mentioned that the London *Times* of 21st May reports the safe arrival there of the two living specimens of *Thylacinus cyanocephalus hyena*, or tiger of Tasmania, sent home last year by Mr. Gunn and Dr. James Grant. It is the first instance of this animal having been imported alive into England or Europe.

The Secretary read a paper by Sir W. Denison, commenting upon the operations of the Annandale Farmers' Club, recently reported in the *Transactions of the Highland Society of Scotland*, from which it appears that an extensive series of experimental observations of great exactness and value have been carried out by practical farmers in the south of Scotland, intended to determine the increase of crop (chiefly turnip), derivable from the employment of various manures applied to soils under varying circumstances, as to the feeding of stock. The average results were:—Swedes, 21 tons and 16 cwt., yellow 20 tons 2 cwt., white 22 tons 7 cwt. to the acre; on land of ordinary fertility it was found that early sowing is advantageous—that the most suitable width between the drills is 28 to 30 inches—that the prevalent rule as to distance between the plants is to hoe out 7 to 8 inches, though the success in cases where 13 and 14 inches have been adopted has been such as to warrant a very general trial of the practice. The narrower spaces appear to suit the Swedes, and the wider the white and red turnips. Farm-yard manure is to be principally depended upon, and it should not be applied in quantities under 16 cubic yards to the acre, unless when 2 cwt. of guano or 12 barrels of crushed bones is used, when 13 to 14 cubic yards may answer. Sir William thinks that the Midland Agricultural Society of Van Diemen's Land should follow in the track of the Annandale Club.

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* Huon pine (*Dacrydium Franklinii*).

† Lightwood, or blackwood (*Acacia melanoxylon*).

‡ Myrtle (*Fagus Cunninghamii*).

Dr. Lillie, Dr. Officer, Capt. Kay, Drs. Agnew and Butler, Mr. Dobson, Mr. Mitchell, and others took part in the discussion.

About ten o'clock, on the motion of Joseph Hone, Esq., seconded by S. Moses, Esq., the thanks of the Society were voted for the various donations, for the paper by Sir W. Denison, and for the other written contributions, and the meeting broke up.

13TH NOVEMBER.—Monthly evening meeting; Dr. Officer, a Vice-President, in the chair.

The following gentlemen were ballotted for and duly elected into the Society:—The Rev. George Wright, of Hamilton; R. De Little, Esq., of Launceston; and A. Kissock, Esq., of Hobart Town.

The presentations were as follows:—"Narrative of a Visit to the Mauritius and South Africa," of James Backhouse, from Mr. G. W. Walker: *Curiosities of the British Museum*, 1 folio volume, 1788, from Mr. Westcott; five parts of the Journal of the Agricultural and Horticultural Society of India, transmitted through the Colonial Secretary here by Mr. Grey, Under-Secretary to the Government of India.

A specimen of effloresced *Alum*, from caverns in the argillaceous rocks near Bridgewater, was received from Mr. Bicheno.

Captain Kay, R.N., sent a box of Tasmanian insects, collected in 1843 by M. Verraux, the French naturalist; also a small collection of dried plants, by Mrs. Kay, from various parts of the island.

Mr. G. R. Lewis sent a sample of *Tapa* cloth, manufactured by the inhabitants of Pitcairn's Island, together with a fragment of the copper sheathing of the *Bounty* sloop-of-war.

Mr. Vicary, of Spring Bay, forwarded a large lizard in spirits, commonly considered venomous, resembling *Cyclodus casuarinæ*, of Darwin.

Mr. Milligan placed upon the table a specimen of a nearly allied species obtained under a piece of decayed wood on the shore of D'Entrecasteaux Channel. Mr. M. also presented the carapace of a large turtle of the *Hawk's-bill* kind, cast ashore on the northern coast of Flinders' Island in 1846 during a gale; and stated it to be known to the Aborigines that turtles have been cast ashore at Swan Port, and that they have been seen more than once by Europeans off the Schoutens, on the east coast of Van Diemen's Land.

Mr. Matson, of the Bank of Australasia, presented a basket and netted bag made by the aborigines of Port Phillip, a stuffed specimen of the Koala *(Phascolarctus cinereus)*, with skins of a Lyre bird *(Menura superba)*, of the Nankin bird *(Nycticorax Caledonicus)*, the Porcupine *(Echidna aculeata)*, and of the Emu *(Dromiceius Novæ Hollandiæ)*, of Port Phillip.

A specimen of anthracite from a thin seam on the estate of Mr. John Abbott, near Three Hut Point, was submitted for examination.

From Mrs. S. H. Atkins, of Storth, Break-o'-Day, was received specimens of the plant caterpillar *Sphæria Robertsii*, of New Zealand.

Two specimens of nodular and jasperous clay-ironstone, from Long Bay, were submitted by D.A.C.G. Mitchell.

Mr. G. A. Makeig, of the Treasury, presented to the Museum a fragment of meteoric iron, a piece of granite from Pompey's Pillar, a specimen of Rock of Gibraltar, crystals of quartz with calcareous spar from the vicinity of Bristol, native copper from the Burra Burra, specimens of cobalt, fossil shells, &c.

Mr. Propsting sent the skin of a large seal, taken a few years ago in Carnelian Bay, for inspection.

The Secretary reported the receipt, at the Society's Gardens, of a case of New Zealand plants from Mr. Hort; of a case of New Zealand plants, per *Munford*, from Capt. Impey, in fine condition; of a case, per *Australasia*, from Mr. Allen, of Stockwell, near London, containing thirty-three plants, well selected; and of a case from W. M'Arthur, Esq., of Camden, containing about sixty Australian and exotic plants, in a good state. These cases are in exchange for plants exported from the Society's Gardens.

The following communication from Francis Cotton, Esq., of Kelvedon, on the two species of pine inhabiting the East Coast, the *Callitris Australis* and the *C. Gunnii*, was read.

" There are two species of *Callitris* in the district of Oyster Bay; one, the *C. Gunnii*, grows to the height of from 4 to 10 feet, on the banks of some of the rivers, and forms a very ornamental shrub for gardens; it bears trimming well, and then grows more dense and bushy, rising up from the ground as a beautiful pyramid. The leaves are of slightly glaucous hue, and to the taste have an aromatic or resinous flavour.

" The other, the *Callitris Pyramidalis*, or Oyster Bay Pine, when standing alone, is also of a handsome pyramidal shape; the leaves have but little of the glaucous hue of the *C. Gunnii*, their flavour is somewhat like that of the rind of an orange, and they have not the subacid of the shrub.

" A few trees have been found 80 feet high, and 2½ feet in diameter; but it is much sought after for timber, and is not usually found now exceeding 60 feet in height, and 18 inches in diameter at the butt.

" The shrub, if carefully taken up with a ball of earth, will bear transplanting well, when under a foot in height; the tree is difficult to transplant, and must be removed when very young,—of the first or second year's growth: the young plant requires protection alike from the frost and hot sun.

" The Oyster Bay Pine is preserved in the district in manner following:— The old trees are burnt down, or fall from some other cause; bush fires partly consume the branches, and cause the cones to open and shed their seeds on the burnt ground, from which young plants spring up. The remains of the old tree and the grasses form a protection to them for two or three years, when they are capable of bearing the vicissitudes of the climate.

" They appear to flourish equally well on the hill tops and sheltered valleys, and are rarely found growing in rich soils, their choice being the hungry white soil of the colony, incumbent on clay.

" The Pine tree is adapted to many useful purposes; the smaller pines are extensively used for rafters to buildings—also for oars, masts, and yards for boats: the larger pines sometimes afford masts and spars for small vessels. The larger trees are sawn into boards for building purposes; they make excellent floors,—and indeed they do well for all the internal fittings of a house, including staircases, sashes, and doors.

" The boards shrink little in drying,—much less, I believe, than any other colonial wood; and they rarely warp while seasoning.

" I have doors, floors, sashes, &c. that have had upwards of twenty years' wear, and, judging from their appearance, the timber must be very durable. Both species of pine furnish a resin which exudes in tears through rents or wounds in the bark of growing trees, from stumps left in the ground—very sparingly, however, from the small shrubby species, and not in great quantity from the tree; it is semi-transparent, brittle, and has a slight resinous taste; dissolved in turpentine it forms a varnish, but sufficient trial has not been made of its value in this respect; it burns readily, with a slow, steady flame.

"For most of these facts I am indebted to my friend Dr. Story,

"FRANCIS COTTON."

Lieut. Clarke, R.E., read a paper by Sir W. T. Denison on the destruction of piles by the *Teredo navalis*, as evidenced in those recently taken up in forming the entrance of the new dock. His Excellency recommended that every opportunity should be seized of making record of any fact proving the liability or non-liability of various timbers we possess to be attacked by this insect. A turbid and unsettled condition of water is thought to retard or even to prevent the operations of the insect; and some appear to consider the Huon pine exempt from its ravages.

After a conversation, in which Dr. Agnew, Lieut. Clarke, Mr. Mitchell, Dr. Officer, and others took part, it was resolved, on the motion of Mr. Hone, seconded by Mr. Hort, that the thanks of the Society be given for the various papers and donations, and the meeting broke up.

11TH DECEMBER.—Monthly evening meeting; His Excellency Sir W. T. Denison, President, in the chair.

The Rev. J. R. Buckland, of the Hutchins School; Francis W. Stieglitz, Esq., of Lewis Hill, St. Paul's; and J. Meyer, Esq., M.D., New Norfolk, were ballotted for and elected.

Captain Tylee, R.E., was admitted on Rule XVIII.

The Secretary reported the presentation to the Museum of the Society, by Peter Fraser, Esq., of a specimen of the spectacled Petrel (*Procellaria conspicillata*), and of the great grey Petrel (*Procellaria hasitata*); of a pouched Lamprey, in spirits, caught in the Clyde, near Bothwell, from W. S. Sharland, Esq., M.L.C.; and a small Lamprey, with an eel-like head, recently taken at the fording-place of the stream at Brown's River, by Morton Allport, Esq. Mr. M. Allport also presented two eggs of the spur-winged plover of Tasmania.

Lieut. Akers, R.E., laid on the table fragments of a silicio-ferruginous conglomerate, from the great bend of the Gordon River, which he has lately visited.

There were upon the table several spirit preparations of fishes from the estuary of the Derwent. A sample of the red oil obtained from the sooty petrel, *Puffinus brevicaudus*. Several teeth of the sperm whale. Two teeth of the Walrus, from Behring's Straits. Eight varieties of wood from Norfolk Island. Several rock specimens from the same place. A collection of casts of fossil shells (*Spiriferæ*) from Eagle Hawk Neck. Specimens of clays and clay rock, with iron pyrites, crystallized in cubes, from Circular Head, and a number of skins of Tasmanian birds, from Mr. Bonney.

The President read a correspondence with the Right Honourable the Secretary of State for the Colonies, and others, on the introduction of salmon into Van Diemen's Land; also a despatch from Earl Grey, with its enclosure—an analysis of the Coal of Tasmania at the Museum of Economic Geology, London, with a report thereon; and another communication on the same subject from Sir H. T. De La Beche, F.R.S., F.G.S., &c., by which it appears that the Geological Society of London will exchange duplicate specimens with the Royal Society of Van Diemen's Land.

Lieut. Clarke, R.E., read a short paper by Sir W. Denison on the formation of dams, with a view to irrigation as peculiarly applicable. and likely to be very valuable to this colony.

The Secretary read the following extracts from a letter of the Rev. W. Colenso to Ronald C. Gunn, Esq., of Launceston, dated Waitangi Hawke's Bay, New Zealand, 4th September, 1850:—

"I have procured two specimens of the ancient, and all but quite extinct New Zealand Rat, which until just now (and notwithstanding all my endeavours, backed, too, by large rewards) I never saw. It is, without doubt, a true *Mus*, smaller than our English black rat, (*Mus Rattus*), and not unlike it. This little animal once inhabited the plains and *Fagus* forests of New Zealand in countless thousands, and was both the common food and great delicacy of the natives—and already it is all but quite classed among the things which were. I have also a bat, which I believe to belong to the genus *Vespertilio*; at all events widely (generically) distinct from the species mentioned by Gray, in Dieffenbach's New Zealand, vol. ii., p. 296. This little creature I kept alive a whole month, and was not a little amused with its habits.

"Among other novelties, I have discovered another and very distinct species of vegetating caterpillar, of which, however, I have only hitherto detected two specimens. It differs widely in general appearance from *Sphæria Robertsii*. Some fine specimens of *Aseroe*, and of that other nearly-allied genus *Illodictyon*, of which I have a new and very large species, which I call *I. laticostæ*, and which, when fully evolved, forms a living net of nearly 18 inches in girth.

"You enquire after an *Apteryx.* How delighted should I be to succeed in getting you one. Three years ago Owen expressed a similar wish, and I have repeatedly tried, but failed. Yet here they still are in the mountain forests, though, doubtless, fast hastening towards extinction. I saw one in its wild state two years ago in the dense woods of the interior; I saw it clearly, and watched its movements for some time without being at all perceived by the creature. It moved quickly along, much like a hen when running after a fly. On seeing me it quickly dived into the untrodden recesses of the forest. Two living specimens were lately taken by the *Acheron*, steamer, to Sydney, where they died; these were obtained at the Bay of Islands, where also I once got three at one time. Since then I have not been able to obtain another, although I have offered a great price for one. The fact is, the younger natives do not know *how* to take them, and the elder ones having but few wants, and those fully supplied, do not care to do so. Further, they can only be captured by night, and the dog must be well trained to be of service; consequently, any hopes of getting specimens are but faint."

A letter to Mr. Milligan, from the Corresponding Secretary of the Royal Hawaiian Agricultural Society, was read, soliciting an interchange of seeds and other objects in Natural History.

The thanks of the Society were voted for donations and papers, and the meeting broke up about ten o'clock.

Miscellanea.

ON THE FOSSIL BOTANY AND ZOOLOGY OF THE ROCKS ASSOCIATED WITH THE COAL OF AUSTRALIA. BY FREDERICK M'COY, M.G.S. and N.H.S.D. &c.

[*Annals and Magazine of Natural History.*]

(Nine Plates.)

THE following paper has been drawn up from an examination of specimens collected by the Rev. W. B. Clarke and sent to the Rev. Prof. Sedgwick, who kindly allowed the writer to make this use of them.

The species will be first noticed, and the new forms described, after which some observations will be offered on the relative ages of the Australian coal-fields, from a comparison of their organic remains with each other, and with those of other countries; premising that the extent of our materials enables this to be attempted in a more extended and precise manner than heretofore, and that several of the new forms described are calculated to throw much light on the fossils of our own country.

In this first part of my paper I wish to express my obligations to the Rev. Prof. Henslow and Mr. Babington for the kindness with which they allowed me the use of their herbaria on all occasions when I found it necessary to work out for myself points of structure in recent plants, neglected by botanists and omitted in their works, but which are of the highest importance in the investigation of fossil plants. To the facilities afforded by the former for my examination of the New Holland plants growing in the houses of the Cambridge Botanic Garden, I am mainly indebted for the maturing my views of the affinities of the genus *Phyllotheca.*

PLANTÆ.

Class ACROGENS. (*Al. Lycopodales*).

Ord. MARSILEACEÆ (?).

Vertebraria. (Royle).

This genus has been proposed by Prof. Royle in his 'Illustrations of the Botany of the Himalaya Mountains' for two species of fossil plants from the supposed oolitic coal-field of Burdwan, but without any description or definition. Similar bodies are not uncommon in the shales and clays of the Australian coal-fields; but although the genus is noticed by Unger in his 'Conspectus Floræ Primordialis,' and Mr. Morris has noticed its occurrence in this district, no botanist has as yet given any descriptive account either of the genus or species; and so obscure are the relations to other forms, that doubts have even arisen as to what part of the plant the radiated cylindrical fossils might be supposed to represent, and how its parts should be named. A distinguished botanist has suggested to me that the cylindrical fossil might be considered a stem, the axis being the pith, the radiating divisional lines the medullary rays, and the intervening cuneiform masses the wedges of wood. I have carefully considered this opinion, but find it impossible to adopt it, from the ease with which the transverse fractures take place, and the perfection of the surfaces produced; as it is obvious that such numerous and perfect divisional planes, as we observe at right angles to the axis, would be incompatible with the above view. On the whole, after a careful study of the specimens at my disposal, I feel disposed to view the genus as closely allied to *Sphenophyllum*, in which we have a jointed stem surrounded by verticillate whorls of from six to twelve wedge-shaped leaves with dichotomous veins; and in this light *Vertebraria* becomes intelligible, for I have clearly ascertained the existence of the dichotomous neuration on each of the wedge-shaped divisions of the transverse planes, which will, according to this view, represent the surface of a whorl of verticillate leaves; and we may consider therefore the main difference between *Sphenophyllum* and *Vertebraria* to consist in the greater approximation of the whorls of leaves in the latter, the internodes being so very short that the whorls of leaves are brought in contact, or nearly so. I might therefore provisionally characterize the genus as follows:—

Gen. Char. Stem slender, surrounded by densely aggregated whorls of verticillate, cuneiform leaves, having a dichotomous neuration.

To the above we might add, that the number of leaves in a whorl depends on the species, and that from the whorls being so close as nearly to touch each other, the fossils have the appearance of lengthened cylinders, breaking readily in a horizontal and vertical direction—the former coinciding with the surfaces of the leaves, the latter coinciding with the vertical prolongations of the lines separating the leaves of each whorl—the former producible in indefinite number at distances of about a line from each other, the latter having only a small definite number depending on the number of leaves in a whorl. The leaves themselves are flat, rather thick, dilated at the tip in such proportion that there is no space left between the edges of the adjacent leaves.

It is very possible that together with *Sphenophyllum* these may have been fresh-water aquatic plants allied to the recent *Marsilea*, in which we see a quaternary arrangement of cuneiform leaves with dichotomous veins, but the affinity is not very strong. The Australian species seems distinct from either of those occurring in the Indian beds by the smaller number of leaves in the whorl, which is perfectly constant in all the examples I have seen. I would propose to name and characterize our species as follows:—

Vertebraria australis (M'Coy). Pl. IX. fig. 1.

Sp. Char. Leaves constantly eight in each whorl.

The fragments are of various lengths, but with a pretty uniform diameter of about seven lines. The radiating dichotomous veins are never strongly marked, apparently from the original softness of the texture of the leaf; in many cases we observe between them an obsolete concentric plication, probably from the same cause, and which may explain the nature of certain vertical striæ visible on the perpendicular fracture, crossing the horizontal lines which mark the edges of the leaves.

This species is abundant in the whitish shales and clays of Mulubimba, N. S. Wales.

(*Al. Filices*).

Ord. GLEICHENIACEÆ.

Gleichenites odontopteroides (Mor.) sp.

Syn. *Pecopteris odontopteroides* (Mor.) in Strzelecki's N. S. Wales.

Having obtained a finely preserved frond of this plant distinctly forked in the manner of *Gleichenia,* I have removed it from *Pecopteris,* in which it was placed by Mr. Morris, and transferred it to the order *Gleicheniaceæ* without hesitation; and taking the verbal characters of Göppert's genus *Gleichenites* — "Frons dichotoma pinnata. Fructificatio hucusque ignota,"—I think there can be no objection to placing it in that genus, although very distinct from his two species *G. artemisiæfolius* and *G. critmifolius.* I might also suggest its relation to the Lias and Keuper genus *Heptacarpus,* with some of the German species of which it generically coincides.

In the sandstone of Clark's Hill, N. S. Wales.

Ord. NEUROPTERIDES.

Odontopteris microphylla (M'Coy). Not figured.

Sp. Char. Bipinnate; pinnæ alternate, oblique, narrow, about three lines wide and two inches long; pinnules alternate, oblique, slightly connate at the base, obtusely elliptical, their length only equalling the width of their base; no midrib, secondary neuration indistinct.

The only *Odontopteris* approaching this elegant species by its alternate pinnæ and very short connected pinnules is the *O. Schlotheimii* (Br.), from which it is distinguished by the smaller size, much narrower and more oblique pinnæ, and by the pinnules being proportionally smaller and elliptical instead of broadly rounded. The latter character also separates it from the so-called *Pecopteris Desnoyersii* (Br.) of the 'Oolithe à Fougères' of Mamers, Sarthe.

Common in the fine sandstone of Clark's Hill, N. S. Wales.

Otopteris, Lind. and Hut.

With Messrs. Lindley and Hutton I use this term for those pinnated plants, the leaves of which agree with *Cyclopteris* in their neuration. Some of these forms were originally described by Lindley and Hutton (Fossil Flora) as *Cyclopteris,* under the impression that the rachis was a rhizoma; Brongniart (Prodrome and Hist. des Végétaux Foss.) gives several of them as *Neuropteris,* apparently neglecting the important character of want of midrib. Göppert confounds both the simple and compound fronds in his *Adiantites* (Syst. Fil. Foss. in Nova Acta Acad. Cæs. Leop. Cur. Nat.), and Unger does the same under the head *Cyclopteris* (Chloris Protogæa). I have, however, thought it desirable to use the term for the pinnate species for which it was proposed, and thus retain *Cyclopteris* for the simple, entire fronds, in accordance with the original view of Brongniart.

Otopteris ovata (M'Coy). Pl. IX. fig. 2.

Sp. Char. Frond pinnate; rachis very thick, slightly flexuous; leaflets little longer than wide, ovate, pointed; upper lobe of the base nearly twice the size of the under, the contracted, thickened base set obliquely on the rachis; veins fine, divaricating; very frequently dichotomizing, nearly equal, but fasciculated at the base.

The fasciculation of the nerves at the base resembles that of the *Cyclopteris flabellata.* The regular, short, semi-elliptical form of the leaflets distinguishes this from the other species of the genus. The average length of the leaflets in the examples I have seen is about 8 lines, width 7 lines, width of rachis 1½ line. Occurs in the hard siliceous flags of Arowa, N. S. Wales.

Cyclopteris angustifolia (M'Coy). Pl. IX. fig. 3 & 3 *a*.

Sp. Char. Leaf linear, lanceolate, eight or nine times longer than wide; sides straight, nearly parallel, pointed above, contracted to a lengthened petiole below; nerves equal, those of the middle third of the frond nearly parallel, straight, rather closer than those of the sides, which gradually divaricate towards the margin at a very acute angle; all the nerves dichotomise at irregular intervals, and those of the sides occasionally anastomose and are connected by a few transverse bars.

In this curious plant we have, as it were, a connecting link between the genera *Cyclopteris* and *Glossopteris;* for although the specimen I have drawn only exhibits the middle portion of the frond, yet I have ascertained that the form is precisely that of a narrow *Glossopteris*, being elliptical or pointed at the apex, and tapering gradually to a lengthened petiole at the base, and still further agreeing in the occasional anastomosing of the lateral veins, and their being connected, though rarely, by transverse bars; yet it is impossible to refer it to that genus from the want of the strong, characteristic midrib, the place of which is occupied by numerous dichotomous nerves of nearly the same thickness as those of the sides; I am therefore obliged to refer it to *Cyclopteris* from a consideration of its more important characters, although differing remarkably in form from the other species of the genus as above restricted. The portion figured, of the middle of a frond, measuring 3½ inches in length, and 9 lines wide at the base, only tapers 2 lines. This species seems common in the gray shale of Guntawang, Mudgee, N. S. Wales.

Ord. SPHENOPTERIDES.

Sphenopteris lobifolia (Mor.).

Common in dark brown shale, Mulubimba, N. S. Wales.

Sphenopteris alata (Br.) sp.

Of large size in the fine gray sandstone of Mulubimba, N. S. W.

Sphenopteris hastata (M'Coy). Pl. X. figs. 1 & 1 *a*.

Sp. Char. Bipinnate; pinnæ long, acutely lanceolate, with a broad alate margin; pinnules elliptical, obscurely undulatodentate, having three obsolete lobes on each side; nerves bipinnate, two branches reaching each lobe of the margin.

The lengthened oval form, slightly indented margin, and simple neuration of the pinnules, fully distinguish this from any published species of the genus. The average length of the pinnæ is about 1½ inch, width 4 lines, average length of leaflets 3 lines.

Not uncommon in the shale of Mulubimba, N. S. Wales.

Sphenopteris germanus (M'Coy). Pl. X. figs. 2 & 2 *a*.

Sp. Char. Bipinnate; pinnæ oblique, alternate elongate, ovate, with a narrow membranous margin; pinnules oval, deeply pinnatifid; lobes very oblique, elliptical, generally three on each side, and the apex of the pinnules three lobed; nerves bipinnate, three branches reaching the margin of each lobe.

It is extremely difficult to distinguish this species from the *Pecopteris Murrayana* of the Yorkshire oolitic coal-fields, with which it is nearly identical in form and neuration. The oval outline of the pinnules is the most obvious character, contrasting with the trigonal, wide-based leaflets of the English plant; this, together with their more oblique setting on the rachis, more oblique, narrow and deeply-cleft lobes, and the decurrent, narrow, alate margin to the straight rachis, will I think be sufficient to distinguish the species.

In the shale of Mulubimba, N. S. Wales.

Sphenopteris plumosa (M'Coy). Pl. X. figs. 3 & 3 *a*.

Sp. Char. Bipinnate; pinnæ curved, elongate, narrow, plumose, with a scarcely alate margin to the rachis; pinnules close, oblique, ovate, pointed, deeply cleft into about four oblique mucronate lobes on each side, exclusive of the largely trilobed apex; nerves strong, much branched, so that about six branches reach the margin of each of the lobes of the lower side, and seven to each of those of the upper margin.

The number of lobes of the leaflets and complexity of the neuration will readily distinguish this species. The average length of the leaflets 5 lines.

Rare in the shale of Mulubimba, N. S. Wales.

Sphenopteris flexuosa (M'Coy). Pl. IX. figs. 4 & 4 *a*.

Sp. Char. Bipinnate; pinnæ very long, with a strongly flexuous naked rachis; pinnules large, moderately oblique, unequal, ovate, sides cut into two very large obtusely rounded lobes on each side; apex trilobed; nerves strong, much branched, seven branches reaching the margin of each lateral lobe, and three going into each of the three lobes of the apex.

This strongly marked species is not sufficiently allied to any published form to render a comparison necessary. The average length of the leaflets is about 8 lines, width 4 lines.

In a brown bed of clay, Mulubimba, N. S. Wales.

Ord. PECOPTERIDES.

Glossopteris Browniana (Br.).

I think I recognise both the Indian and Australian forms of this species (vars. *a.* and *B.* of Brongniart) in nearly equal abundance among the specimens examined, and some of the fronds are of a size far exceeding any hitherto published, some of them being six inches wide, which in the proportion of the small, perfect examples would indicate a frond of more than two feet in length. I believe I have ascertained the rhizoma of this species, which is furnished with ovate, clasping (or at least very convex) subcarinate scales, having a divaricating reticulated neuration, resembling that of the perfect frond, but much less strongly marked; these scales are of large size, some of them being nearly an inch in length, and terminating at the apex in a long flat linear appendage, about one line in width, which occasionally gives off small, lateral, flat, membranous branches nearly at right angles; the whole perfectly resembling (except in size) the rhizomal scales of *Acrostichium*, *Laromanes*, and *Hymenodium*, as figured by M. A. Fée in his beautiful 'Mémoire sur la Fam. des Fougères,' and when combined with the great similarity in form, habit and neuration, would warrant us in presuming a strong affinity to exist between these genera.

Abundant in the soft reddish shales of Jerry's Plains, and also in the black shales and white clay beds of Mulubimba, N. S. W.

Glossopteris linearis (M'Coy). Pl. IX. figs. 5 & 5 *a*.

Sp. Char. Leaves very long, narrow, with nearly parallel sides; midrib very large; secondary veins fine, forming an angle of about 50° with the midrib, anastomosing occasionally from the midrib to the margin.

It is only with the *Glossopteris angustifolia* (Br.) from the Indian coal-fields of Rana-Gunge, near Rajemahl, that this long, parallel-sided frond could be confounded, and it is distinguished easily from that species by the fineness of the neuration, which is as remarkably delicate as that of the other is coarse; the neuration of the *G. angustifolia* is also distinguished by its great obliquity, forming an angle of about 30° with the midrib, while the nerving of the present species is not more oblique than that of the *G. Browniana* or *G. Nilsoniana.* In this species also, from the anastomosing being continued up to the margin, it results that the nerves are little closer at the margin than at the middle of the leaf, while in the *G. angustifolia* the anastomosing is confined to the central portion, and the dichotomising goes on to the margin, where in consequence the neuration is finer and closer than towards the midrib. None of the specimens are perfect at the extremities, the largest being three inches long and seven lines wide at the basal fracture, and diminishing about two lines in that length towards the distal end, being about eight lines wide in the middle. Disconnected fragments show that the base diminishes insensibly to a lengthened petiole, as in the *G. Browniana*, and that the apex is elliptical and pointed.

Very abundant in the gray shale of Wollongong; not uncommon in the hard siliceous schists of Arowa, N. S. Wales.

Pecopteris? tenuifolia (M'Coy). Pl. IX. fig. 6.

Sp. Char. Bipinnatifid (?); pinnules and rachis very slender, each about half a line wide; pinnules very long, oblique, linear, apparently simply united to the rachis by their entire base, one very strong midrib running throughout; secondary nerves unknown.

If this be truly a *Pecopteris*, it is distinct from all others by its very narrow, linear leaflets. The only plant I have seen at all resembling it is the *Zamites obtusifolius* from the shale of the oolitic coal-fields of Blackheath, Richmond, United States, exhibited some weeks since by Mr. Lyell to the Geological Society. The specimens alluded to of this latter plant seem imperfectly preserved, but still show, on some portions of the pinnules, a neuration running parallel with a strong midrib. This great midrib seems to me incompatible with *Zamites*, so that, although I point to the resemblance between the American and Australian plants, I prefer placing the latter provisionally in *Pecopteris*, as I have seen no trace in my imperfectly preserved specimens of a parallel neuration; and even if it should hereafter be found to exist, I conceive it would be necessary to form a new genus, intermediate in form, neuration, and (I think) mode of attachment of the pinnules to the rachis, between *Zamites* and *Pecopteris*, for the reception of those two plants.

One specimen has occurred in the fine sandstone of Clark's Hill, N. S. Wales.

Class ENDOGENS. (*Al. Palmales*).

Ord. PALMACEÆ.

Zeugophyllites elongatus (Mor.).

Common in the shales of Mulubimba, N. S. Wales.

Class EXOGENS. (*Al. Amentales*).

Ord. CASUARINACEÆ (?).

Phyllotheca (Br.).

M. Brongniart, in his 'Prodrome,' founds this genus for a single species, the *P. australis*, of which he mentions having a large number of well-preserved specimens, which he describes as "des tiges simples, droites, articulées, entourées de distance en distance par des gaînes appliquées contre cette tige, comme dans les *Equisetum*, mais terminées par de longues feuilles linéaires, qui remplacent les dents courtes des gaînes des Prêles. Ces feuilles sont ou dressées, ou plus souvent étalées, et même réfléchies; elles sont linéaires, aiguës, sans nervure distincte, au moins deux fois plus longues que la gaîne. Les gaînes elles-mêmes présentent de légers sillons longitudinaux, qui disparaissent vers la base, et qui semblent correspondre à l'intervalle des feuilles, comme les sillons des gaînes des *Equisetum* correspondent à l'intervalle des dents. La tige, dans l'espace qui sépare les gaînes, paroît lisse; mais sur des fragmens de tiges un peu plus grosses, qui appartiennent probablement à des individus plus âgés, de la même plante, on voit des stries régulières, presque comme sur les Calamites." While, on the other hand, Messrs. Lindley and Hutton in their 'Fossil Flora (article *Hippurites gigantea*) state, that having examined specimens communicated by Dr. Buckland (from whom also Brongniart received his), they found Brongniart's description inaccurate, and that the leaves, instead of springing from the edge of the sheath, arise immediately from the stem, and having in addition to the whorl of distinct leaves "a sheath originating within them and closely embracing the stem, to which it gives the appearance of the barren shoots of an *Equisetum*, with its whorls of slender branches on the outside of a toothed sheath." Unger, in his 'Chloris Protogæa,' referring both to Brongniart and Lindley and Hutton, defines the plant as "Caulis simplex, rectus, articulatus vaginatusque. Folia verticillata linearia, enervia contracta v. expansa, vaginas articulorum strictas circumdantia." Mr. Morris, I believe the latest writer on this plant, closely follows Brongniart in his observations on its structure.

I have now stated what I believe to be all the published information regarding this very interesting form; and as it has not been hitherto figured, and the published accounts are contradictory among themselves, and none of them as I find strictly applicable to the plant, it may be interesting to detail some of the observations I have been enabled to make on those specimens which have come under my notice.

I find in the whitish clay beds of Mulubimba a profusion of plants having cylindrical jointed stems, the joints surrounded by sheaths, and the free edge of each sheath terminating in a whorl of long, linear leaves. Here we have all the essential characters of *Phyllotheca*, but beyond this there is no agreement with the descriptions of those few botanists who have seen the plant. And here I may be permitted to state, that, from the number of specimens which I have examined with great care, there remains not a doubt on my mind of the accuracy of M. Brongniart's view of the relation of the whorls of leaves to the sheaths: I have traced them distinctly in every instance as arising from the free edge of the sheath, and lying either straight, inclining obliquely outwards, or, as is most commonly the case, completely reflexed, as I have represented in the drawing Pl. 11. fig. 2: and their occurrence in this position may have deceived Messrs. Lindley and Hutton as to their real connexion with the sheaths; for when the long slender leaves are completely reflexed and pressed in a reversed position against the sheaths, broken specimens may easily have their inferior mistaken for their superior extremities; and if when in this position the leaves be supposed to point upwards, they will really have the appearance of originating as an independent whorl of leaves *outside of the base of the sheath*, as described in the 'Fossil Flora.' This double arrangement would be so anomalous, that it is the more important to have the means of ascertaining the true relation of those parts in accordance with Brongniart's original view.

Brongniart describes the stem as smooth, and I find the specimens before me apparently divisible into two groups, one having the stem smooth, the other having it coarsely sulcated longitudinally, as in *Calamites*. All the botanists alluded to agree in describing the stem of *Phyllotheca australis* as simple;—*all the sulcated stems* I have seen are simple, but a number of the smooth or slightly striated stems are distinctly branched, and in a manner quite distinct from *Equisetum*. In *Equisetum*, if we view with most botanists the sheaths as produced by the mere lateral union of the leaves, and thus representing the foliage of other plants, we have the extraordinary character of the branches arising, not as axillary buds originating immediately above and within the base of the leaves, but originating *below* the joints and external to the sheaths. This is not the case with the fossil before us, in which the branches originate directly over the joints, and are therefore within and axillary to the sheaths, which may thus, with their appendages, be considered as true leaves, and having the same relation to the branches as in ordinary plants. This character is of such importance, that the resemblance of *Phyllotheca* to *Equisetum* is proved by it to be of the most trifling nature, and that there can be no real affinity between them. On the other hand, when compared with *Casuarina*, the affinity seems to me to be exceedingly strong, although botanists have not, I believe, hitherto so considered it. The *Casuarinæ* are exogenous weeping trees, with slender cylindrical branches; their shoots regularly jointed, longitudinally sulcated, and surrounded at the joints with toothed sheaths as in *Equisetum;* while the branches originate either in a verticillate or irregular manner immediately above the joints and within the sheaths, showing a perfect agreement with the above-mentioned *Phyllotheca*. But a still more interesting and important proof of the relation of those plants to *Casuarina*, and removing them still farther from *Equisetum*, is to be found in their mode of inflorescence, of which I have fortunately noticed a fragment among the specimens at my disposal. The specimen alluded to is a portion of a branch (see Pl. XI. fig. 1) with the joints more approximate than on other parts of the plant, their length being scarcely equal to their diameter; the sheaths are the exact length of the internodes, and fringed on their upper margin with a dense little whorl of (I think two-celled) anthers, agreeing very closely with *the male flowers* of *Casuarina stricta* and allied species, with which (being in flower at this time in the houses of the Cambridge Botanic Garden) I have been enabled to compare it as advantageously as the state of preservation of the fossil would allow. The fructification of *Equisetum* is entirely different, forming a dilated, club-shaped mass at the end of the branches or at the extremity of a particular stem. The *Phyllotheca australis* is described as having the sheaths closely applied to the stem, the leafy appendages twice the length of the sheaths, without midribs, and having the naked portion of the stem between the sheaths smooth. Of the two species which I have seen this would best agree with the branched one, which however has a midrib, although not a very prominent one. The species which agrees with the definition in being simple-stemmed, differs in having the sheaths very loose or infundibuliform, and so long as to extend the entire way from one joint to the next, so as to leave no bare space of the stem visible; the leaves are very long and have a strong prominent midrib, and the stem when deprived of the sheaths is seen to be always coarsely sulcated. Under these circumstances the obvious course seems to be to modify the definition of the genus so as to include the two species under consideration, and to characterize them as distinct species. If the supposed affinity with *Equisetum* were borne out, I should probably have considered the loose-sheathed, simple-stemmed plant as the fertile shoot, and the branched stems with small tight sheaths as the barren shoots, following the analogy of some of our best-known recent species of *Equisetum;* but having seen that they are constructed in an essentially different manner, we cannot do better than as I have proposed.

I may then briefly characterize the genus and species as follows :—

Phyllotheca.

Gen. Char. Stem slender, jointed, simple or branched; branches springing from above the joints, not arranged in the same plane; surface smooth or longitudinally sulcated; articulations surrounded by sheaths, the free edge of which terminates in long narrow leaves, having a more or less distinct midrib. Inflorescence arranged in whorls near the extremity of certain branches.

I have only to add to the above characters, that the ridges of the sulcated stems do not alternate at the joints in the regular manner of *Calamites,* nor is there any trace of the peculiar tubercles so generally seen in that genus (an additional proof, if such were wanting, that Brongniart's original explanation of those tubercles being connected with the vascular system of the sheath is not the correct one, for here we have enormously developed sheaths and no tubercles). The verticillate whorls of leaves, whenever I have seen them perfectly expanded, seemed always elliptical as in *Annularia,* the leaves of two opposite points of the circumference being considerably longer than the rest. The genus is distinct from *Annularia* by the great development of the sheath or connected base of the leaves, and by the branches being inconstant, and when present, not being arranged in pairs in the same plane.

Phyllotheca australis (Br.).

Sp. Char. Stem simple, smooth or slightly striated; sheaths tight, shorter than the internodes, terminated by narrow leaves, double the length of the sheaths, without distinct midrib. (*Condensed from Br.*)

Phyllotheca ramosa (M'Coy). Pl. XI. figs. 2 & 3.

Sp. Char. Stem branched, smooth, or slightly striated; sheaths half the length of the internodes; leaves thin, linear, flat, twice to three times the length of the sheath, with a very fine indistinct midrib.

This beautiful plant has the branches weeping or hanging downwards as in *Casuarina,* about half the diameter of the stem; they do not arise from every joint, but they do nearly; I am uncertain whether more than one spring from any one joint. Most of the stems are perfectly smooth, being striated only at the articulation (see Pl. XI. fig. 3), while others have a delicate lineation down the internodes; the first I imagine to be stript of their bark, and the latter to retain it; and here again we have another proof of the stronger affinity of our fossil to *Casuarina* than to *Equisetum,* for I find by examining the living *Casuarinæ* that the lineation of the surface goes no deeper than the bark, while the elevated lines on the surface of *Equisetum* are only the edges of strong septa going towards the central hollow, and the flat spaces between those lines are only the superficial coverings of tubular hollow spaces between the aforesaid septa, so that destroy the surface of *Casuarina* and you render the stem smooth—destroy the surface of *Equisetum* and you only increase the coarseness and strength of the sulcation. I may also add (in accordance with this view) that age or size has no connexion with this lineation of the surface, as is suggested by

M. Brongniart in the last few lines of the quotation from his work at the head of this subject, for I find some of the largest stems perfectly smooth and the smallest occasionally striated. The sheaths are rather coarsely striated, and terminate in thin, flattened leaves, the midrib of which is scarcely discernible. In the weeping or downward curved branches the leaves are completely reflexed so as to point upwards, and, according to the position of the stem, are either reflexed, expanded, or lying straight up against the stem. The stems vary from 3 to 7 lines in diameter.

Common in the white soft shale of Mulubimba, N. S. Wales.

Phyllotheca Hookeri (M'Coy). Pl. XI. figs. 4, 5, 6, 7.

Sp. Char. Stem simple, coarsely sulcated and ridged longitudinally; sheaths very large, loose subinfundibuliform, each sheath extending from one articulation to the next, so as to conceal the stem; leaves about twice the length of the sheaths, thick, narrow, and with a strong, prominent midrib.

This species is easily known from the two former by its great loose sac-like sheath, completely concealing the stem (see Pl. XI. figs. 4 & 5), its long, thick, strongly ribbed leaves (see Pl. XI. fig. 6), and by its stem when stripped of its sheath being coarsely and regularly sulcated, precisely as in the *Calamites Cistii* (see Pl. XI. fig. 7). Although abundant, I have never seen a trace of a branch. Some of the flattened stems attain a width of two inches.

Common in the sandstone of Clark's Hill, in the siliceous schists of Arowa, and in the shales at Mulubimba, N. S. Wales.

ZOOPHYTA.

Stenopora crinita (Lonsd.).

Very abundant, forming globose masses five inches in diameter, with a mammillated surface like that of the *Ceriopora verrucosa* (Gold). In the sandstone of Woollongong, N. S. Wales; also in the sandstone of Darlington; more rare in calcareous beds at Black Head, N. S. Wales.

Stenopora ovata (Lonsd.).

Common in Darlington sandstone, N. S. Wales.

Stenopora Tasmaniensis (Lonsd.).

Not uncommon in the sandstone of Darlington, N. S. Wales.

Fenestella ampla (Lonsd.).

Common in the sandstones of Muree, Bell's Creek, and Loder's Creek, N. S. Wales.

Fenestella fossula (Lonsd.).

Common in the sandstone of Muree, N. S. Wales.

Fenestella internata (Lonsd.).

Common in the sandstone of Bell's Creek and Darlington, N. S. Wales.

Fenestella undulata (Phil.).

Rare in the shale of Dunvegan, N. S. Wales.

Fenestella.

Two species closely resembling the *F. antiqua* (Lonsd.) (the

Devonian variety) and the *F. plebeia* (M'Coy) of the British carb. slate, but not determinable with certainty from their state of preservation: common in the shale of Korinda, N. S. Wales.

Glauconome.

A species most allied to the *G. pluma* (Phil.) of the British carboniferous rocks, and perhaps identical with it, but not in sufficiently good preservation to determine. Common in the shale of Dunvegan, N. S. Wales.

Cladochonus (M'Coy), new genus.

Gen. Char. Polypidom of very thick, straight, slender, calcareous tubes, suddenly dilating at short regular distances into large oblique, cup-shaped terminal chambers, longitudinally striated within; from the point where the dilatation commences, a second slender tube similar to the first is given off at an angle varying with the species, and terminating at the same distance as the former in a similar cup, bent in nearly an opposite direction to the first, and giving rise at its base to a third slender tube as before. The whole polypidom erect, attached by the base only, which embraces some foreign body.

These singular and beautiful corals have some relation to *Aulopora*, but differ in their curious erect habit, regular, angular mode of branching, slender, equal, stem-like tubes and abruptly dilated terminal cups bent in nearly opposite directions. The *Aulopores* are attached for the most part by one side; the tubes *gradually* expand to the mouths, which all open nearly in one direction; they have no regular distance for branching, and frequently anastomose. The present corals have also much thicker walls to the tubes, the central hollow being proportionally very small. I formerly described some species of this group under the genus *Jania*, being uncertain where to place them; such are the *J. crassa* and *J. bacularia* of the 'Synopsis of the Irish Carb. Limestone Fossils,' which should now be removed to this genus.

Cladochonus tenuicollis (M'Coy). Pl. XI. fig. 8.

Distinguished by the slenderness of the stems. Common in the Dunvegan shale.

Strombodes? Australis (M'Coy). Pl. XI. fig. 9.

I have given the above name provisionally to a species of *Strombodes* from the calcareous shale of Wagamee, N. S. Wales, having the precise form of the *Turbinolia fungites* of British writers. It is certainly without transverse chambers, having the vertical lamellæ twisted about the centre; the lamellæ are about thirty-six in number, all reaching the centre, though grouped in irregular bundles as they approach it. The section is slightly oval, the lamellæ in the direction of the long axis being straight, those of the sides much arched. The external surface is striated longitudinally, the striæ being double the number of the lamellæ.

Turbinolopsis bina (Lonsd.).

Agreeing minutely with Devonshire specimens. Rare in the shale of Dunvegan, N. S. Wales.

Amplexus arundinaceus (Lonsd.).

Common in the gray limestone of Curradulla or Limestone Creek, N. S. Wales.

CRINOIDEA.

Tribrachyocrinus (M'Coy), new genus.

Gen. Char. Cup globose; pelvis (or dorso-central plate) large, saucer-shaped, pentagonal, tripartite; first costals (or first row of perisomic plates) five, one pentagonal, three hexagonal, and one (?) heptagonal; one of the hexagonal costals is truncate above and supports one pentagonal interscapular plate; between these and the heptagonal costal is situated one large, roundish, pentagonal, intercostal plate; in the re-entering angle between this latter and the summit of the heptagonal costal is an obscurely hexagonal plate, analogous to a second costal. Scapulæ (or ray-bearing plates) three, rhomboidal or obscurely pentagonal, upper margin rounded, lower margin pointed; two of those in the re-entering angles between the first costals and one in the angle between the intercostal plate and the second costal. Interscapular plates three, shield-shaped, pentagonal; upper margin broad, straight, truncate, with the two upper lateral angles horizontally extended into short angular processes.

The singular Crinoid for which I propose this genus is very differently constructed from any other of the generic groups with which I am acquainted. The cup is not symmetrical in form, like that of other Crinoids, but is, as it were, humped on one side by the interpolation of the large irregular intercostal (marked *h* in the diagram) and the second costal (*i*). The only specimen found is slightly crushed laterally, so as to render this inequality of the sides very remarkable. The arm-bearing plates or scapulæ, which are so generally five in the other genera, are only three in the present animal, forming a strong peculiarity which it shares only with the genus *Triacrinus* of Count Münster (Beiträge zur Petrefactenkunde), a little Crinoid of the Eifel differing in every other respect from the Australian form. The general disposition of the plates is most analogous to that of *Poteriocrinus*, from which it differs in the number of the scapulæ and every point of detail. I am as yet only acquainted with one species of the genus, which it is not possible therefore to characterize specifically: I have dedicated it to the Rev. W. B. Clarke, to whose zeal we owe the specimens described in this paper.

Tribrachyocrinus Clarkii (M'Coy). Pl. XII. fig. 2.

The surface is smooth, with the exception of a few irregular radiating plicæ at the margin of some of the plates, which seem in some cases to overlap each other—an appearance, however, which may be deceptive. Length of the cup 1 inch 7 lines, width about 1½ inch.

From the soft gray shale of Darlington, N. S. Wales.

Actinocrinus.

Fragments of pelvic plate of this genus occur in the Dunvegan shale, and large columns apparently of *Cyathocrinus* are common in the limestone of Wagamee, N. S. Wales, and also in the limestone of Wollamhoola, N. S. Wales.

CRUSTACEA.

(*Entomostraca.*)

Bairdia curtus (M'Coy), Synop. C. L. Foss. Pl. XXIII. fig. 6.

This little creature is perfectly identical with those I have described and figured, from the lower limestone of Kildare, in the 'Synopsis of the Carb. Limestone Fossils of Ireland.'

Mr. Morris, in Count Strzelecki's work, has noticed a *Bairdia* which he says is intermediate between my *B. gracilis* and *B. curtus*, being more slender than the latter; but his figure is greatly more gibbose, so that I am uncertain whether his *B. affinis* be really distinct or not. At any rate there can be no doubt with regard to the present examples, which are from the shale of Dunvegan, N. S. Wales.

Cythere impressa (M'Coy), Synop. C. L. Foss. Pl. XXIII. fig. 16.

This is another species which I have described from the shales at the base of the carboniferous series in Ireland, and from the complexity of its form is, if possible, a still more positive identification than the last; the agreement in outline, central hollow, and its little marginal tubercle, &c. being absolutely perfect, and admitting of no doubt. It is certainly very curious to see those two genera and species of minute Crustaceans occurring together in the shales at the Antipodes just as we see them in our own lower carboniferous beds.

Occurs with the *B. curtus* in the shale of Dunvegan, N. S. Wales.

(*Trilobita.*)

Brachymetopus (M'Coy), new genus.

Gen. Char. Cephalothorax truncato-orbicular; limb narrow, produced backwards into flattened spines; glabella smooth, cylindrical or ovate, about twice as long as wide, not reaching within about its own diameter of the front margin; one pair of small, basal, cephalothoracic furrows, or none. Eyes reniform, in the midst of the cheeks (? smooth); eye-lines unknown. Surface strongly granulated; one tubercle on each side of the anterior end of the glabella, the marginal row and a circle round each eye being larger than the rest. Body-segments unknown. Pygidium nearly resembling the cephalothorax in size and form, rather more pointed, strongly trilobed, and with a thickened prominent margin; axal lobe about as wide as the lateral lobes, of about seventeen narrow segments; lateral segments about seven, divided from their origin, each terminating in a large tubercle at the margin.

The minute Trilobites for which I propose the present genus are very distinct in habit from those of other genera, and as two or three species are now known, it seems desirable to place them together under one name. They are the smallest perfect Trilobites known, from two to three lines being the greatest width they have been seen to attain. The *Phillipsia Maccoyi* of Capt. Portlock's Geol. Report on Londonderry, &c. certainly belongs to this genus, and is at first sight difficult to distinguish specifically from the Australian species. The Irish species alluded to was collected by the writer from the lower carboniferous limestone of Kildare, and sent to Captain Portlock for his monograph of Irish Trilobites, under the impression that it formed the type of a new genus and species; but probably from there being but one specimen it was placed provisionally by that author in his genus *Phillipsia,* from which it differs in its small, short glabella, smooth eyes, want of cephalothoracic furrows, &c. Having now examined numerous specimens of the Australian species, there can be no longer any doubt of the distinctness of the group from *Phillipsia,* from the characters of the cephalothorax, and the pygidium is still more distinct. From those materials I have therefore drawn up the above characters, which it is believed will distinguish them easily from the other generic types. From the general similarity in the structure of the pygidium, I am inclined to refer the fossil which I have named *Phillipsia* (?) *discors* (Synopsis of the Carb. Limestone Foss. of Ireland, pl. 4. fig. 7. p. 161) to the same genus. This is also a very small Trilobite, the length of the pygidium being only three lines; and although referring it provisionally to *Phillipsia,* I suggested in the above work that it should, when better known, form the type of a distinct genus, which, however, it was not possible to frame until now. I have dedicated the present species to Count Strzelecki, whose fine work on the physical features of New South Wales and Van Diemen's Land has so materially advanced our knowledge of that country, and who has recorded the existence of minute Trilobites (undetermined) in the limestone of Yass Plains, which probably belong to this group, if not to this species.

Brachymetopus Strzeleckii (M'Coy). Pl. XII. fig. 1.

Sp. Char. Glabella widest at the base, with one very minute obscurely marked cephalothoracic furrow at the base on each side; all the segments of the pygidium with an irregularly tuberculated ridge along the middle; lateral segments forming large tubercles where they join the thickened limb, opposite each of which is a short slender spine projecting from the margin.

The greater size of the glabella and its being widest at the base will distinguish the head from that of the *P. Maccoyi* (Portk.), and the granulation extending entirely across the segments and the spinose margin will distinguish the pygidium from that of the *P. discors* (M'Coy).

Width one and a half line.

Common in the shale of Dunvegan, N. S. Wales.

Phillipsia.

A species closely resembling the *P. gemmulifera* (Phil. sp.), but not distinctly preserved, occurs in the shale of Dunvegan, N. S. Wales.

MOLLUSCA.

(*Brachiopoda.*)

Atrypa cymbæformis (Mor.).

Very common in the sandstone of Muree, N. S. Wales, and in the impure limestone of Black Head, N. S. Wales.

Atrypa biundata (M'Coy). Pl. XIII. figs. 9 & 9 *a*.

Sp. Char. Longitudinally ovate, gibbose, smooth; front narrow; margin raised in two rounded waves, from which two obsolete rounded ridges extend a short way towards the beak on the ventral valve, and one obscure rounded mesial ridge extends nearly to the beak on the dorsal valve.

This species closely resembles the *A. hastata* (Sow.) of the British Mountain Limestone, and may have been confounded with it; it is, however, perfectly well distinguished by the character of the front margin, which in *A. hastata* is straight and even, but is elevated and bent into a double fold in the Australian species, somewhat as in the less exaggerated varieties of the *Terebratula biplicata* (Sow.) of the oolites (from which it is known by its imperforate beak, &c.); also *both* valves of the *A. hastata* are plano-concave towards the front margin, while the dorsal valve of the present species presents an obtuse mesial convexity. Length 1 inch 1 line, width 10 lines, thickness 7 lines.

Common in the dark limestone of Black Head, N. S. Wales, in the coarse conglomerate of Korinda, N. S. Wales, and in the gray schists of Lewin's Brook, N. S. Wales.

Atrypa Jukesii (M'Coy). Pl. XIII. fig. 8.

Sp. Char. Transversely oval, length two-thirds the width; sides with eight or nine large, acutely angular, simple plaits, extending from the beak to the margin, which they deeply indent; mesial elevation moderate, square, of five slightly angular simple plaits, much smaller than those of the sides.

This species is closely allied to the *A. pleurodon* (Phil.) of the carb. limestone of Britain, and the *A. fallax* (Sow.) of the upper Devonian and lower carboniferous shales of England and Ireland, but is distinguished by the dissimilarity in size and angulation between the mesial and lateral plaits; the mesial plaits are, if anything, a little larger than those of the sides in the British forms alluded to. Length 4½ lines, width 7 lines.

Common in the Dunvegan shale.

I have dedicated this species to my friend Mr. Jukes, who has geologically examined a considerable portion of the country and collected many fossils, which I have not as yet seen.

Spirifera (*Reticularia*) *crebristria* (Mor.).

This species has got a distinct cardinal area, and could not therefore belong either to *Terebratula* or *Athyris*, as suggested by Mr. Morris; it is, in fact, a typical example of that little group of *Spirifers* for which I have suggested the name *Reticularia* in the 'Synop. Carb. Foss.' &c., distinguished by their small size, area and hinge-line as in *Martinia* (M'Coy), (that is, the former shorter than the width, and the latter moderately large), in addition to a reticulated surface and *parallel dental lamellæ.* Is this really distinct from the *Spirifera* (*Ret.*) *microgemma* (Phil.) of the Devonian and lower Irish carboniferous shales? On comparison I scarcely think it is.

Rather rare in the schists of Dunvegan, and in the fine sandstone forming the summit of a hill one mile south of Trevallyn, N. S. Wales.

Spirifera vespertilio (Sow.).

Not uncommon in the impure limestone of Black Head, N. S. Wales, and abundant in the dark calcareous schists of Eagle Hawk's-neck, Van Diemen's Land.

Spirifera calcarata (Sow.).

I cannot in the slightest particular distinguish examples from the sandy shales of Dunvegan, N. S. Wales, from those so abundant in Devonshire and in the lower carboniferous shales and sandstones of Ireland.

Spirifera avicula (Sow.).

Abundant in the sandstones of Korinda, also occasionally in the limestone of Blackhead, N. S. Wales.

Spirifera Darwinii (Mor.).

Common in the sandy schists of Loder's Creek and Barraba; more rare in the arenaceous limestone of Blackhead, N. S. Wales.

Spirifera subradiata (Sow.).

Common in the sandstone of Muree, in the arenaceous limestone of Blackhead, in the schists of Woollongong, and in the fine sandstones of Darlington, N. S. Wales.

Spirifera subradiata (? var. resembling *S. glabra*).

Common in the sandstone of Maitland, and in the arenaceous limestone of Irrawang, N. S. Wales.

Spirifera attenuata (Sow.).

Specimens perfectly undistinguishable from the *larger variety* so abundant in the lower carboniferous shales of Ireland (as at Hook Point, co. Wexford), are common in the arenaceous shales of Dunvegan, N. S. Wales.

Spirifera Tasmaniensis (Mor.).

Common in the hardened schists of Lewin's Brook, N. S. Wales.

Spirifera lata (M'Coy). Pl. XIII. fig. 7.

Sp. Char. Transversely rhomboidal, moderately gibbose, width four times the length; sides flattened, regularly attenuating to the very acute cardinal angles; cardinal area broad, flat; mesial fold wide, defined, angular, smooth; about sixteen to eighteen slightly convex, simple, smooth ribs on each side of the mesial fold, becoming indistinct as they approach the cardinal angles, so as to leave nearly a third of the length of the sides smooth.

This differs from the widest varieties of the *S. disjuncta* (Sow.) by its defined and smooth mesial hollow, extent of the smooth space at the end of the sides, and the smaller number and greater width of the radiating ridges, which are also much less prominent; the smoothness of the mesial fold and width of the cardinal area separate it from the *S. convoluta* (Phil.); and from the *S. Rœmerianus* (Kon.) it is known by its size, greater width, smooth cardinal extremities, and flatter and wider lateral ridges. Length 1 inch 1 line, width 4 inches.

From the hard schists of Lewin's Brook, N. S. Wales.

Spirifera duodecimcostata (M'Coy). Pl. XVII. figs. 2 & 3.

Sp. Char. Transversely oval, or subrhomboidal gibbose; sides rounded; hinge-line shorter than the width of the shell; cardinal area wide, triangular, curved; mesial ridge prominent, deeply divided by a mesial sulcus; mesial hollow wide, deep, defined and showing a mesial ridge corresponding to the mesial sulcus of the ridge of the ventral valve; five or six strong, subangular simple ridges on each side of the mesial fold.

Length of dorsal valve 1 inch 3 lines, width 1 inch 9 lines. Not uncommon in the calcareous grit of Wollongong, and in the sandstone of Muree, N. S. Wales.

Spirifera oviformis (M'Coy). Pl. XIII. figs. 5 & 6.

Sp. Char. Longitudinally ovate, longer than wide; hinge-line much shorter than the width of the shell; sides rounded, gibbose; mesial ridge large, rounded, divided by a deep furrow; mesial hollow very wide, flat, undefined; three or four large, rounded prominent ribs on each side of the mesial fold, rendered obscurely nodulose by the obtuse concentric undulations of growth.

This is one of the very few *Spirifers* in which the length exceeds the width, by which character it may be known from all the varieties of the *S. subradiata*. The figures on the plate are from two different specimens. Length 2 inches 6 lines, width 2 inches 3 lines.

Not uncommon in the sandstone of Barraba, N. S. Wales.

This species and the last belong to the subgenus *Brachythyris* (M'Coy).

Orthis striatula (Schlot.).

On the most careful comparison I find nothing to distinguish the Australian specimens from those so common in the Eifel and lower Irish carboniferous shales.

Abundant in the hard rock of Lewin's Brook, N. S. Wales.

Orthis Australis (M'Coy). Pl. XIII. figs. 4 & 4*a*.

Sp. Char. Longitudinally obovate, very depressed, uniformly convex, length nearly equalling the width; width greatest towards the front margin, narrowing towards the hinge-line, which slightly exceeds half the width of the shell; sides and front margin nearly straight, slightly convex; surface with very numerous, fine, nearly equal dichotomous striæ radiating from the beak.

This is closely allied to the upper Devonian and lower carboniferous fossil to which Prof. Phillips restricts the name *O. interlineata*, and to the carboniferous *O. Michelini* (Lév.), (*O. filiaria*, Phil.). From the former it is distinguished by its narrow, longitudinally obovate figure, and from the latter by its wider hinge-line and much finer striæ; and from both it differs in the form of its muscular impressions. Length 7 lines, width 7½ lines.

Abundant in the shales of Lewin's Brook, N. S. Wales.

Orthis spinigera (M'Coy). Pl. XIII. fig. 3.

Sp. Char. Longitudinally obovate, gently convex; length of ventral valve two-thirds the width, width greatest near the front margin, narrowing rapidly towards the hinge-line, the length of which is little more than half the width towards the front; cardinal area triangular, flat, half as high as wide; sides of the shell much rounded; front margin without sinus, slightly convex; surface with two or three strong distant imbrications of growth, crossed by numerous small, strong, angular, radiating ridges (about twenty-two at two lines from the beak); they are nearly equal in thickness, but shorter ones are interpolated, chiefly at the concentric imbrications of growth, between each pair of the primary ones as they approach the margin, beyond which, when well preserved, they are produced into slender conical spines; they are about their own diameter apart, the intervening flat spaces being coarsely striated across.

Somewhat allied to the Russian *O. plana* (Pand. sp.), but very distinct by the character of the striation and by the short hinge-line and comparative width of the front. Length of ventral valve 5 lines, width 7 lines; height of cardinal area 2 lines, width of hinge-line 4 lines.

Rare in the shale of Dunvegan, N. S. Wales.

Productus antiquatus (Sow.).

Reticulated rostral portions well preserved and perfectly undistinguishable from the British carboniferous specimens.

Common in the hard schist of Lewin's Brook, N. S. Wales.

Productus brachythærus (Sow.).

Very common in the calcareous grit of Loder's Creek, and also at Korinda, N. S. Wales.

Productus setosus (Phil.).

I find the Australian species undistinguishable when minutely compared with our common British mountain limestone species above-named. In the dark indurated schist of Lewin's Brook, N. S. Wales.

Productus scabriculus (Sow.).

In the calcareous flags and dark limestone of Hull's quarry, Hobart Town: associated with this there is abundance of a flatter species, concentrically wrinkled and with more irregularly placed, blunt, round spines, which may, or may not, be distinct from the *P. fragaria* and *P. caperata* of the upper Devonian and lower Irish carboniferous shales; but from the state of preservation I cannot satisfy myself of the species.

Productus undulatus (M'Coy). Pl. XIII. fig. 2.

Sp. Char. Subquadrangular, one-third wider than long, gibbose, front slightly concave at the margin; sides nearly rectangular, obtusely rounded; beak large, tumid; surface with fine, close, short, undulating transverse wrinkles; a few obscure traces of oblong spines towards the margin.

This species is slightly allied to the *Leptæna lepis* of the Eifel, and the *L. membranacea* and *L. mesoloba* (Phil. Pal. Foss.), but is distinguished from the two first by its gibbose quadrangular form, concave front, and large tumid beak; and from the latter by its want of mesial ridge and spines, and by the fine transverse plication of the surface. Length 7 lines, width 10 lines.

Rare in the sandstone of Loder's Creek, N. S. Wales.

Leptæna ——— ?

A species closely resembling the *L. Hardrensis* (Phil.), but more square in outline, not so wide, and more coarsely striated, is common in the shale of Dunvegan, N. S. Wales; it also resembles the *Chonites Laguesianus* of the Belgian carb. shale and the *Chonites Falklandica* of the Falkland Islands; but as I have not examined either of those latter species, I prefer leaving the determination of the Australian form uncertain.

Orbicula affinis (M'Coy). Pl. XIII. fig. 1.

Sp. Char. Longitudinally ovate, very much depressed; margin slightly undulated; apex acute, excentric towards the right side, one-third of the length from the anterior edge; surface with fine, sharp, irregular concentric plicæ.

This is only to be distinguished from the *Orbicula Davreuxiana*, (Kon.) of the Tournay carb. shale by the fine, sharp, concentric plication of the surface. Length 3 lines, width 2¼ lines, height three-fourths of a line.

From the shale of Dunvegan, N. S. Wales.

(*Lamellibranchiata.*)

Pecten squamuliferus (Mor.).

Common in the fine, olive-coloured schists of Wollongong, N. S. Wales.

Pecten ptychotis (M'Coy). Pl. XIV. fig. 2.

Sp. Char. Ovato-orbicular, width very slightly exceeding the length, convex, smooth; ears unequal, posterior one obtuse-angled, undefined, anterior ear narrow, square at its extremity, divided by a deep, acutely angular sinus, from the body of the shell; surface smooth, except the extremity of the anterior ear, which is longitudinally plicated.

It is only by the plication of the extremity of the anterior ear that this can be known from the *P. variabilis* (M'Coy) so abundant in some of the carboniferous shales of Ireland. Length 4 lines, width one-fourth of a line more.

Common in the shale of Dunvegan, N. S. Wales.

Pecten sub-5-lineatus (M'Coy). Pl. XVII. fig. 1.

Sp. Char. Truncato-orbicular, convex, equilateral, beaks tumid; ears large, nearly equal, flattened, the posterior one slightly pointed and separated at the margin from the body of the shell by a deep rounded sinus; anterior ear broad, nearly square, with a slightly convex margin; surface of both ears and body of the shell marked with a few obtuse concentric waves of growth, and radiated with rather coarse narrow rounded ridges, those of the ears being close and equal, while those of the body are rather distant from each other, the interspaces being flat; about twenty-five proceeding directly from the beak to the margin, where they are about two lines apart; between those at a short distance from the beak are interpolated an equal number of rather thinner ones, which again receive nearer the margin two fine striæ between each of them and the adjoining primary ridge.

The striation of this fine species resembles that of the *P. quinquelineatus* (M'Coy, Syn. Carb. L. Foss.); that is to say, near the margin and towards the middle of the shell there are five striæ between each pair of primary ones, the middle or odd one of the five nearly equalling the primary ridges in thickness. The present fossil has, however, much finer striæ than the Irish species alluded to, and the arrangement is much less definite, becoming confused in size and number towards the sides; it is also distinguished by its greater convexity. Length 2 inches 9 lines, width the same.

Rare in the greenish, fine sandy beds of Harper's Hill, N. S. Wales.

Avicula tessellata (Phil.).

I cannot distinguish the specimens occurring in the soft greenish schists of Dunvegan, N. S. Wales, from those in the precisely similar shale at the base of the carboniferous series at Lisnapaste, in the north of Ireland.

Pterinea macroptera (Mor.).

Rare in the white rock of Port Arthur, V. D. Land.

Eurydesma cordata (Mor.).

Common in the arenaceous limestone of Arthur's Hill, N. S. Wales.

Inoceramus Mitchelii (M'Coy). Pl. XIV. fig. 1.

Sp. Char. Longitudinally ovate, one-fifth longer than wide, slightly oblique, inflated; hinge-line oblique, nearly equalling the width of the shell, forming a slightly compressed wing; beaks pointed, prominent, incurved, close to the anterior end; anterior side nearly straight, abruptly subtruncate; surface with numerous strong, concentric, irregular wrinkles of growth.

The hinge margin of this species is much thickened, which removes it from *Posidonia*, while, as in many of the German cretaceous *Inocerami*, it is not possible to observe any traces of the transverse ligamentary pits, nor can we be sure whether those species possessed them or not; meanwhile I shall leave the present species in the same genus as its obvious allies alluded to; and even if future research should prove that ligamentary pits did not exist, we should form a distinct genus for those species, which, like the present and the *I. vetustus* (Sow.) of the mountain limestone, are distinguished from the true semimembranous *Posidoniæ* of the lias and palæozoic shales with which they have been confounded, by their thick shells, general form, and thickened hinge-margin. Length 2 inches 3 lines, width 1 inch 9 lines, thickness about 1½ inches.

Common in the sandstones of Glendon and Wollongong, N. S. Wales.

Dedicated to Sir T. Mitchell, one of the first to make known the existence of fossils in those rocks.

Pleurorhynchus Australis (M'Coy). Pl. XVI. fig. 4.

Sp. Char. Alæform or transversely subtrigonal, gibbose, length nearly two-thirds the width; posterior side forming a compressed narrow wing; anterior face obliquely subtruncate, convex, divided into three nearly equal tumid compartments by two impressed furrows from the beak; body of the shell and posterior side radiated with rather coarse irregular ridges from the beak; anterior face finely striated longitudinally.

This resembles the *P. minax* (Phil.) in the striation of the anterior face being so much finer than that of the middle or posterior parts of the surface; it differs in having the anterior face not only much more finely striated, but divided into three parts by distinct furrows; while from the *Cardium irregulare* and *C. strangulatum* (Kon.), which have the anterior face so divided, but smooth, it is distinguished by this latter character, and also by wanting the mesial strangulation of those species. Length of small specimen 8 lines, width 1 inch.

Not uncommon of larger size in the sandy schists of Wollongong, N. S. Wales.

Allorisma curvatum (Mor.).

Common in the sandstones of Darlington, Wollongong, and Glendon, N. S. Wales.

Orthonota compressa (Mor.).

In the calcareous schists of Harper's Hill, N. S. Wales.

Orthonota costata (Mor.).

Common in the sandstone of Wollongong, N. S. Wales.

Modiola crassissima (M'Coy). Pl. XV. figs. 2 & 3.

Sp. Char. Transversely ovate, very gibbose: beaks small, nearly terminal; anterior side forming a small rounded lobe beneath the beaks, separated from the body of the shell by a strong sinus in the ventral margin, from which a shallow concavity runs towards the beak; posterior side wide; hinge-margin elevated, four-fifths the width of the shell in length, compressed, angulated, posterior end broadly rounded; ventral margin convex; shell very thick; surface with a few concentric waves of growth, and marked towards the posterior inferior angle with a few distant obsolete ridges, extending obliquely from the beaks.

Length 5 lines, width 1 inch 7 lines, height of cardinal angle 11 lines (occasionally 3½ inches wide).

Not uncommon in the schists of Harper's Hill, N. S. Wales.

Pachydomus carinatus (Mor.).

Abundant in the fine sandy schists of Wollongong, N. S. Wales; more rare in the white rock of Port Arthur, V. D. Land.

Pachydomus globosus (Sow. sp.).

Common in the sandstone of Wollongong, N. S. Wales.

Pachydomus gigas (M'Coy). Pl. XVI. fig. 3.

Sp. Char. Transversely oval, length two-thirds of the width, very gibbose, inflated; beaks very large, incurved, placed in about the anterior third of the shell; posterior side obliquely truncated, the angles rounded; posterior slopes compressed, flattened; posterior ridge obtusely rounded, almost disappearing before reaching the posterior inferior angle; anterior side small, narrowed, with a slightly marked sinus between it and the convex ventral margin; surface marked with small concentric cord-like sulci and ridges.

This is distinguished from the *P. globosus* (with which Mr. Morris seems to include it) by its greater width in proportion to the length, by the flattened, compressed sides of the posterior slopes and the more oblique truncation of the posterior end, and the smallness and narrowed appearance of the anterior side, arising from a slight, but always perceptible, sinus between it and the convexity of the ventral margin. The shell is very thin in this species, which makes a near approach to *Leptodomus* (M'Coy) in all its characters. Length 4½ inches, width 6 inches 3 lines (often much larger).

Common in the fine sandstone of Wollongong, N. S. Wales.

Pachydomus sacculus (M'Coy). Pl. XIV. fig. 5.

Sp. Char. Subquadrate or satchel-shaped, length nearly equalling the width, thickness two-thirds the length; gibbose towards the beak, compressed towards the ventral margin; beaks large, nearly central, strongly incurved towards the anterior side; posterior side forming a short, compressed, rectangular wing; anterior side very obliquely truncated; anterior and posterior slopes abruptly rounded, and the angles formed by their junction with the ventral margin equal, broadly rounded and nearly equidistant from the beak; abdominal margin broadly concave, giving the middle of the valves a flattened, slightly hollowed appearance; shell very thick, foliaceous; surface with a few obtuse concentric elevations and numerous irregular concentric lines of growth.

Length 4½ inches, width 4 inches 9 lines. I am uncertain whether the specimen figured is from Black Head or Wollongong, N. S. Wales.

Pachydomus ovalis (M'Coy). Pl. XIV. fig. 4.

Sp. Char. Transversely oval, length five-sixths of the width, compressed, thickness rather more than two-thirds of the length; beaks tumid, nearest the anterior end; anterior and posterior ends oval, rounded, the latter obscurely angulated at end of hinge-line; ventral margin regularly convex; surface marked with thick, unequal, cord-like concentric striæ, lunette deep ovate; ligament external, large.

The anterior and posterior adductor impressions are large and oval; the impression of the retractor of the foot very small, lunate, just over the anterior adductor; pallial impression with a small rounded sinus before joining the posterior adductor. Distinguished from the *P. lævis*. (Sow.) by the coarse concentric lineation of the surface. Length 1 inch 8 lines, width 2 inches.

Very common in the sandstone of Wollongong, N. S. Wales.

Pachydomus ? pusillus (M'Coy). Pl. XVI. figs. 1 & 2.

Sp. Char. Small, ovato-orbicular, width slightly exceeding the length, globose, thickness four-fifths the length; beaks very large, tumid, much incurved into the anterior cordiform space, which is unusually deep; anterior side short, rounded; posterior end rounded; ventral margin very convex; ligament very large, external; muscular impressions large, anterior deep oval, posterior impression shallow, lunate, pallial impression entire; shell thick, surface rough with strong concentric imbricating lines of growth.

This curious little species resembles an *Isocardia;* but from the great size of the external ligament, thick shell and general habit, I have placed it in the present genus, but not without doubt, from its diminutive size and peculiar proportions. Length 10 lines, width 11 lines.

Common in the sandy schists of Wollongong, N. S. Wales.

Cardinia (?) *exilis* (M'Coy). Pl. XV. fig. 1.

Sp. Char. Transversely ovate, compressed, cuneiform, slender, twice as wide as long; dorsal margin convex; beaks small, one-sixth of the width from the anterior end; posterior end attenuated, obtusely pointed; anterior side small, rounded; anterior half of the ventral margin convex, posterior half slightly concave; surface with strong irregular imbricating laminæ of growth and close intervening imbricating striæ.

This reminds us of the *Unio* (*Cardinia*) *acuta* (Sow. sp.) of the European coal-fields, but is distinguished by its greater thickness, more clavate form, and arched dorsal margin. The muscular and pallial impressions correspond with those of the lias species of the genus generally, but the dental impressions are obscure. Length 1 inch 1 line, width 2 inches 2 lines.

From the sandstone of Wollongong, N. S. Wales.

Notomya (M'Coy), new genus.

Gen. Char. Shell transversely ovate, equivalve, inequilateral, compressed, greatest thickness behind the middle of the shell; gaping slightly at both ends; beaks small, compressed; cardinal slope not distinguished from the sides of the shell; shell thick, surface concentrically lineated; ligament external, large. Cast: a wide shallow furrow runs obliquely from the beak about half-way towards the ventral margin; a shallow spoon-shaped hollow extends from the beak to the impression of the posterior adductor muscle, bounded by a low ridge on each side in each valve; traces of a simple cardinal tooth beneath the beak of the right valve; muscular impressions deep, anterior adductor large ovate, not attenuated above; posterior adductor broadly lunate; retractor of the foot small, oval, immediately over the anterior adductor; pallial impression with a small rounded sinus before joining the posterior adductor.

It is with those Muschelkalk *Myacites* of Schlotheim and Bronn' and such like forms, of which M. Agassiz, in his 'Etudes Critiques sur les Mollusques Fossiles,' has composed his genus *Pleuromya*, and with those forming his genus *Gresslya*, that the present fossils have the strongest affinity. They are, however, perfectly distinct from those essentially Jurassic and Triassic types, by the small size of the sinus in the pallial impression. In minor characters it differs from the *Gresslyas* in the small size of the beaks, and the more compressed form of the sides (the greatest thickness in *Gresslya* being always before the beaks, and gradually diminishing towards the posterior end, while the greatest thickness in *Notomya* is *behind* the beaks, depriving them of the characteristic wedge-like form of *Gresslya.*) The present genus is destitute of the cardinal ridge in the right valve, so remarkable in *Gresslya*, having in its place a shallow, attenuated, ovate hollow, bounded by two obscure ridges in each valve, thus approaching *Pleuromya*. The shell also is much thicker than in the above genera, and the impressions of the muscular and pallial scars much deeper and more strongly marked in consequence; the impression of the anterior adductor is pear-shaped, pointed and attenuated above in *Gresslya*, but simply oval in *Notomya*. The *Pleuromyœ* differ in nearly all the same points as *Gresslya* from the present genus (except the cardinal ridge), and differ besides in the elevation or upward curvature of the cardinal line and the convexity of the posterior two-thirds of the ventral margin corresponding with it, those parts being oppositely inclined in *Notomya*. The oblique mesial or post-mesial furrow from the beak in the cast of *Notomya* does not exist in the other two genera, but in *Pleuromya* there exists a somewhat similar furrow, but different in position, arising *in front* of the beaks, and extending directly to the ventral margin close to the anterior end. *Cardinia* (Ag.), which somewhat resembles the present genus, is distinguished by its entire pallial impression and dental characters.

Notomya securiformis (M'Coy). Pl. XV. figs. 5 & 5 *a*.

Sp. Char. Transversely ovate, flattened; length two-thirds the width, thickness rather less than half the length; beaks small, flattened, rather more than one-third the width from the anterior end; anterior end narrowed, rounded; posterior end narrow, subtruncate, nearly square; anterior two-thirds of the ventral margin very convex, a shallow concavity in the posterior third; muscular impressions very large, anterior one deepest, ovate, posterior one shallow, broad, reniform; pallial scar strongly marked, parallel with the ventral margin as far as the anal angle, then a small subangular sinus before joining the adductor impression; retractor impression small, deep, narrow, oval; in the cast the oblique furrow from the beak towards the ventral sinus wide, shallow; remains of a cardinal tooth under the beak of the right valve.

Length 1 inch 6 lines, width 2 inches 2 lines, thickness 11 lines. The figures of this species display most of the generic characters. Sandstone of Wollongong, N. S. Wales.

Notomya clavata (M'Coy). Pl. XV. fig. 4.

Sp. Char. Transversely clavate; length two-thirds the width, evenly convex, greatest thickness towards the posterior half; beaks very small, compressed, rather more than one-fifth the width from the anterior end; anterior end very broad, evenly rounded; anterior third of the ventral margin very convex, middle portion widely concave; posterior end narrowed, obliquely subtruncate, rounded; muscular impression shallow, anterior large ovate, posterior broad lunate; retractor small, broad, oval; oblique longitudinal furrow from the beak deep, narrow above, widening nearly to the marginal concavity; impression of one simple cardinal tooth beneath the beak of the right valve; the long spoon-shaped hollow extending from the beaks to the posterior muscular impressions, and its lateral bounding ridges obscurely marked.

Distinguished from the *N. securiformis* by its broadly rounded anterior side, smaller beaks, thinner shell, and consequently more faintly marked ridges and impressions on the cast, and by the middle of the ventral margin being concave instead of very convex, and the sides evenly convex instead of flattened. Length 1 inch 6 lines, width 2 inches 2 lines. Common in the sandstone of Wollongong, N. S. Wales.

Besides the above, there is a third species of *Notomya* equally common in the sandstone of Loder's Creek, but of which none of the specimens were good enough to figure or describe; it has the strong mesial oblique furrow from the beak of the cast, small sinus in the mantle scar, and other characters of the genus, but differs from the preceding species in its regular oval outline, &c. It might be named *N. ovalis*.

Pullastra? striato-costato (M'Coy). Pl. XIV. fig. 3.

Sp. Char. Transversely oblong, depressed, nearly twice as wide as long, dorsal and ventral margins nearly parallel, anterior and posterior ends elliptically rounded; beaks rather large, one-third of the width from the anterior end; surface with about twelve strong angular ridges parallel with the margin; those ridges are finely striated in the direction of their length.

The striation parallel with the ridging distinguishes this from the *Pullastra bistriata* (Portk.) of the Irish carb. shale; and there being no flat space between the angular ridges, and its less width and straight ventral margin, distinguish it from the *M. scalaris* (Phil.) of Devonshire. Length 2 lines, width 3½ lines. Common in the shale of Dunvegan, N. S. Wales.

Venus? gregaria (M'Coy). Pl. XVI. fig. 5.

Sp. Char. Orbicular, compressed, evenly convex; beaks prominent, slightly nearer the anterior side; lunette deep ovate, smooth; external ligament short, prominent; surface covered with coarse rounded concentric striæ; margin crenulated within.

This pretty little species occurs gregariously in great numbers in some spots in the sandstone of Wollongong, N. S. Wales, principally as hollow casts, which at first sight resemble impressions of the *Atrypa decussata*. Length 4 lines.

(*Gasteropoda.*)

Euomphalus minimus (M'Coy). Pl. XVII. fig. 4.

Sp. Char. Greatest diameter one line; spire depressed, of three small whorls; basal whorl deeper than the spire, rounded, mouth wider than long; umbilicus small, rounded; surface smooth.

Common in the shale of Dunvegan, N. S. Wales.

Pleurotomaria subcancellata (Mor.).

In the fine calcareous sandstone of Loder's Creek, N. S. Wales.

Pleurotomaria Strzeleckiana (Mor.).

Common in the fine calcareous grits of Wollongong, N. S. Wales.

Pleurotomaria Morrisiana (M'Coy). Pl. XVII. fig. 5.

Sp. Char. Acutely conical, width four-fifths of the length; volutions four or five, each having a small double keel below the middle, and a slightly tumid margin to the sutures; no umbilicus; surface with fine close unequal striæ arched backwards from the suture to the keel. Width 4 lines, length scarcely 5 lines.

As the characters of this little species seem to have been already recognized and slightly alluded to by my friend Mr. Morris (in Count Strzelecki's work), I dedicate it to him. It is, as he observes, something like the *P. conica* (Phil.), but smaller and more elongate. Abounds in some parts of the limestone of Black Head, N. S. Wales, and rare in the sandstone of Muree, N. S. Wales.

Platyschisma rotundatum (Mor.).

Abundant in the dark arenaceous limestone of Harper's Hill, N. S. Wales.

Platyschisma oculus (Mor.).

Common in the arenaceous limestone of Harper's Hill.

(*Pteropoda.*)

Theca lanceolata (Mor.).

Abundant in the dark arenaceous limestone of Black Head, N. S. Wales. I observe that, at the longitudinal furrows, the ends of the transverse sulci alternate with each other as in *Conularia.* Those longitudinal furrows are not noticed by Mr. Morris in his description of the genus and above-named species; but they exist, of the same number as in *Conularia,* one coinciding with the principal (? dorsal) ridge, two being placed a little on the (? posterior) side of the lateral angles, and one in the middle of the flat (? anterior) side. It is of importance to notice those obscurely-marked furrows, as bringing more clearly to view the relations of the genus *Theca* with *Conularia.* The transverse sulci are crossed by very minute longitudinal striæ.

Conularia lævigata (Mor.).

Common in the fine gray micaceous sandstone of Black Creek, N. S. Wales, and in the limestone of Harper's Hill, N. S. Wales.

Conularia torta (M'Coy). Pl. XVII. figs. 9 & 10.

Very elongate-conic, diminishing in diameter at the rate of one line in two inches; section oval; lateral longitudinal channels only two (?), placed with a slight obliquity to the long axis of the shell, giving it a twisted appearance, being placed at the sides (or extremities of the short axis) of the oval section at the base, and being at the ends (or extremities of the long axis) of the oval section near the small end; sides very convex, without mesial furrow; transverse sulci coarse (about fifteen in half an inch), continued uninterruptedly across from one side furrow to the opposite.

This extraordinary fossil seems to differ from all known *Conulariæ* in having but two instead of four longitudinal furrows (for although MM. D'Archiac and Verneuil give an oval section of their *C. Brongniartii* showing but two furrows, I suppose this to be erroneous, as it neither agrees with their description nor larger figure).

This is distinctly seen in the small fragment here figured, as well as the uninterrupted passage of the transverse ridges from one oblique sulcus to that on the opposite side, and the undivided nature of the intermediate faces. The larger specimen figured is not so perfect, but shows the slow rate of increase. The transverse sulci are about as numerous as in the *C. lævigata*, but that species has four unequal, divided faces, and is, together with all the described species, so different as not to require a particular comparison. The oblique or twisted direction of the longitudinal sulci above-noticed, I find also to exist in the recent *Creseis spinifera* of the Mediterranean; so that what would otherwise seem an anomalous character of the present fossil tends rather to strengthen the affinity between *Conularia* and the recent *Pteropoda.*

Not uncommon in the sandstone of Muree, N. S. Wales.

Conularia tenuistriata (M'Coy). Pl. XVII. figs 7 and 8.

Sp. Char. Quadrangular, pyramidal, section rhomboidal, tapering at the rate of two lines in one inch; sides unequal, two narrow sides flat or slightly convex, about half the width of the two wide ones, which are slightly concave; a strong longitudinal furrow down each of the lateral angles, and a faintly-marked one in the middle of each of the broad faces; ,transverse striæ very fine, twenty-seven to twenty-nine in the space of half an inch, passing uninterruptedly, with a slight upward curve, across the broad faces, more nearly straight on the two narrow ones.

This species equals or even exceeds the *Conularia Gerolsteinensis* in the fineness of its transverse striation, while it is distinguished from that and all other species with which I am acquainted by the great disproportion in the width of the sides. One specimen, imperfect at both ends, measuring 1½ inch long, had the long diameter at the base 9 lines, the short diameter at the base 4½ lines; long diameter at smaller end 6½ lines, short diameter at ditto 3 lines.

Not uncommon in the sandstone of Muree, N. S. Wales.

(*Cephalopoda.*)

Bellerophon micromphalus (Mor.).

Common in the impure calcareous beds of Wollongong, N. S. Wales; rare in the sandstone of Muree, N. S. Wales.

Bellerophon interstrialis (M'Coy). Pl. XVII. fig. 6.

Sp. Char. Globose; keel obtuse, rounded; surface with sharp spiral striæ, each pair having two or three finer lines between them, and the whole reticulated by sharp tranverse elevated striæ, which form little tubercles at the intersections.

Closely allied to the Irish carboniferous *B. interlineatus* (Portk.), from which it is known by the strong reticulation of its surface.

Rare in the Dunvegan shale, N. S. Wales. Width 4 lines.

Nautilus.

A species resembling the carboniferous *N. sulcatus*, but too imperfect for specific determination, occurs in the Dunvegan shale, N. S. Wales.

CONCLUSION.

Having far exceeded the limits I had originally intended for the preceding part of this paper, I find it only possible to give a brief outline of those general topics on which I intended to have dwelt. First, as to what has been already done: geologists are familiar, from the labours of M. de Strzelecki and others, with the fact that there exists a series of stratified deposits, consisting of siliceous and argillaceous slates, limestones and sandstones, stretching at irregular intervals from the Liverpool range of mountains in New South Wales to the extremity of Van Diemen's Land, and forming detached masses, probably at one period continuous; those contain abundant fossil remains of animals referable to the palæozoic period.

Above these we have a series of clays, shales and sandstones, with remains of fossil plants and beds of coal, occupying three great basin-shaped hollows; one in the district about the Hawkesbury River in New South Wales, and called the Newcastle basin, and the two others in Van Diemen's Land, called respectively the South Esk and the Jerusalem basins. The animal beds containing the palæozoic remains are found, with one doubtful exception, to dip constantly under the coal-bearing strata, at every point of observation; for the most part at the same angle as that at which the coal crops out: the exception alluded to is a point near Spring Hill, Van Diemen's Land, where masses of clay containing *Pachydomus globosus* seem to rest on a sandstone containing remains of plants, and which is known to belong to the top of the coal series: Count Strzelecki, who made this observation, doubts its correctness himself, and expressly states that it needs re-examination to establish the fact of those *Pachydomus* clays really existing in this position. Nevertheless the inference has been drawn from this observation, that the Jerusalem coal-basin was much older than that at Newcastle, New South Wales, where the sandstones containing the *Pachydomi* were always seen to dip distinctly under the coal-measures: countenance was apparently given to this supposition by the few plants which were collected from Jerusalem coal-field proving to be all specifically and some generically distinct from those known to exist in the Newcastle basin. When to this we add, that the beds containing the fossil animal remains rest on a siliceous breccia, the age of which is unknown, and that the coal strata are overlaid by variegated sandstone and yellow limestone, supposed from its few organic remains to belong to the pleiocene period, we have I believe stated all that is known on the geological relation of those deposits.

With regard to their palæontology,* we have seven species of plants noticed in M. de Strzelecki's work by Mr. Morris, one of which is identical with a species from the Indian coal-field of Burdwan; and the general resemblance to the oolitic plants of Britain is noticed, as well as the absence of the characteristic forms of the older genuine coal-fields of Europe. In the inferioı strata there are forty-eight species of animal remains noticed, one of which is supposed to be identical with a species of the British mountain limestone; the remainder are all (except two new types) of palæozoic genera; but the absence is remarked of *Nautilus*, the true *Leptænæ* and *Orthidæ*, all of which, however, I have now been able to add.

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* Since the above was printed, I learn from a letter of Mr. Dana's that he is just putting to press his account of the palæontology of this district, which, as Naturalist to the United States Exploring Expedition, he has recently investigated under more favourable circumstances than any of his predecessors; we may soon, therefore, expect from this accomplished naturalist a great addition to our knowledge on this subject.

In the above notice I have given seventeen species of fossil plants from the Mulubimba district, which is a portion of the great Newcastle and Hawkesbury basin, twelve of which are considered new. Those plants belong to ten genera, two of which (*Vertebraria* and *Zeugophyllites*) are only known here and in the supposed oolitic coal-fields of India: one genus (*Gleichenites*) I have provisionally used for the *Pecopteris odontopteroides* of Morris, from the verbal characters given by Göppert for that genus, the species of which are found only in the palæozoic coal; the plant, however, agrees much better with the species of the Keuper genus *Heptacarpus* than with those of the carboniferous *Gleichenites*, and if we look rather to the plants themselves than to the definitions given of the genera, I should certainly place it there: all the other genera (with the exception of *Phyllotheca*, which is confined to the locality) are well known in the oolitic coal deposits of Yorkshire; and one species, the *Sphenopteris germana* (M'Coy), is scarcely to be distinguished from the common *Pecopteris Murrayana* (Br.) of the Scarborough shales. Several of those genera are common both to the carboniferous and oolitic periods, but the most abundant and characteristic plants of the Australian beds belong to a genus (*Glossopteris*) never found in the old coal-fields, but several species of which are, on the other hand, well known in coal-beds of the oolitic age in various parts of the world. I am therefore strongly of opinion, from the evidence of more than double the number of species of plants known before, that the coal deposits of Australia should be referred to the oolitic period; and this opinion derives much additional weight from the negative fact, that among the large quantity of remains of plants which I have examined from this district, not a trace has been observed of any of the characteristic carboniferous genera—not a trace of *Lepidodendron* or any allied plant—not a trace of *Sigillaria*, *Favularia*, *Stigmaria*, or even of true *Calamites*. I might further add, that the list of plants I have given destroys any negative arguments formerly based on the fossil evidence, for considering the Jerusalem coal-basin to be of a different age from the Newcastle one, as I have detected the most characteristic plants of the former abundantly in the latter beds, so that the fossil evidence now would go, with the admitted identity of the walls of the basins and the general analogy of the sections, to prove them all of one age.

In the underlying rocks I have been able to determine 83 species of animal remains, of which 14 are *Zoophyta*, 3 *Crinoidea*, 4 *Crustacea*, 25 *Brachiopoda*, 24 *Lamellibranchiata*, 6 *Gasteropoda*, 4 *Pteropoda*, and 3 *Cephalopoda* (including *Bellerophon*). Of these, 4 genera and 32 species are figured and described as new. Those 83 species belong to 39 genera, all of which (with the exception of the genera *Tribrachyocrinus*, *Pachydomus*, *Notomya*, and *Eurydesma*, —new forms at present only known in Australia) are abundant in the carboniferous rocks of Britain, many of them not being found in any higher series, and several of them not being known in any older deposits, so that the age, even if *we only look to the genera of the fossils*, is clearly limited to the carboniferous period; but when we descend to the critical examination of species, we find so extraordinary and unexpected an amount of agreement between those beds and the similar shales, sandstones and impure limestones forming the base of the carboniferous system in Ireland, that it is impossible not to believe them to be nearly on the same parallel, and there is equal difficulty in imagining them to be either younger or older than those deposits. Of those species no less than eleven are believed to be positively identical, on the most careful comparison of the Australian and Irish specimens, and nine more are so closely allied that it has been found impossible to detect any difference of character, but which, either from imperfect preservation or want of sufficient specimens to display all the characters, have not been specifically identified. With such evidence as I have mentioned, I do not think it improbable that a wide geological interval occurred between the consolidation of the fossiliferous beds which underlie the coal, and the deposition of the coal-measures themselves; that there is no real connexion between them, but that they belong to widely different geological systems, the former referable to the base of the carboniferous system, the latter to the oolitic, and neither showing the slightest tendency to a confusion of type.

EXPLANATION OF PLATES IX TO XVII.

PLATE IX.

Fig. 1. Vertebraria australis (M'Coy).
Fig. 2. Otopteris ovata (M'Coy).
Fig. 3. Cyclopteris angustifolia (M'Coy).
Fig. 3 *a*. Neuration of ditto magnified.
Fig. 4. Sphenopteris flexuosa (M'Coy).
Fig. 4 *a*. Pinnule of ditto magnified to show the neuration.
Fig. 5. Glossopteris linearis (M'Coy).
Fig. 5 *a*. Neuration of ditto magnified.
Fig. 6. Pecopteris (?) tenuifolia (M'Coy).

PLATE X.

Fig. 1. Sphenopteris hastata (M'Coy).
Fig. 1 *a*. Pinnule of ditto magnified.
Fig. 2. Sphenopteris germana (M'Coy).
Fig. 2 *a*. Pinnule of ditto magnified.
Fig. 3. Sphenopteris plumosa (M'Coy).
Fig. 3 *a*. Pinnule of ditto magnified.

PLATE XI.

Fig. 1. Inflorescence of Phyllotheca.
Fig. 2. Phyllotheca ramosa (M'Coy).
Fig. 3. Decorticated stem with scar of branch.
Fig. 4 & 5. Phyllotheca Hookeri (M'Coy).
Fig. 6. Magnified part of leaf of ditto to show the midrib.
Fig. 7. Stems of ditto, without their sheath, to show their sulcation.
Fig. 8. Cladochonus tenuicollis (M'Coy). Lower figure magnified.
Fig. 9. Strombodes (?) australis (M'Coy).

PLATE XII.

Fig. 1 *a*. Brachymetopus Strzeleckii (M'Coy): head natural size and magnified.
Fig. 1 *b*. Ditto, pygidium natural size and magnified.
Fig. 2 *a* & *b*. Tribrachyocrinus Clarkii (M'Coy).
Fig. 2 *c*. Plates of ditto expanded.

Plate XIII.

Fig. 1. Orbicula affinis (*M'Coy*).
Fig. 2. Producta undulata (*M'Coy*).
Fig. 3. Orthis spinigera (*M'Coy*).
Fig. 4. Orthis autralis (*M'Coy*).
Fig. 4 *a*. Ditto, internal cast.
Figs. 5 & 6. Spirifera (Brachythyris) oviformis (*M'Coy*).
Fig. 7. Spirifera lata (*M'Coy*).
Fig. 8. Atrypa Jukesii (*M,Coy*).
Figs. 9 & 9 *a*. Atrypa biundata (*M'Coy*).

Plate XIV.

Fig. 1. Inoceramus Mitchellii (*M'Coy*).
Fig. 2. Pecten ptychotis (*M'Coy*).
Fig. 3. Pullastra (?) striato-costata (*M'Coy*).
Fig. 4. Pachydomus ovalis (*M'Coy*).
Fig. 5. Pachydomus sacculus (*M'Coy*).

Plate XV.

Fig. 1. Cardinia (?) exilis (*MCoy*).
Figs. 2 & 3. Modiola crassisima (*M'Coy*).
Fig. 4. Notomya clavata (*M'Coy*).
Figs. 5 & 5 *a*. Notomya securiformis (*M'Coy*).

Plate XVI.

Fig. 1. Pachydomus (?) pusillus (*M'Coy*): internal cast.
Fig. 2. Ditto, surface.
Fig. 3. Pachydomus gigas (*M'Coy*).
Fig. 4. Pleurorhynchus australis (*M'Coy*).
Fig. 5. Venus (?) gregaria (*M'Coy*).

Plate XVII.

Fig. 1. Pecten subquinquelineatus (*M'Coy*).
Fig. 2. Spirifera (Brachythyris) duodecimcostata, dorsal valve.
Fig. 3. Ditto, ventral valve.
Fig. 4. Euomphalus minimus (*M'Coy*).
Fig. 5. Pleurotomaria Morrisiana (*M'Coy*).
Fig. 6. Bellerophon interstrialis (*MCoy*).
Fig. 7. Conularia tenuistriata (*M'Coy*).
Fig. 8. Ditto,
Figs. 9 & 10, Conularia torta (*MCoy*).

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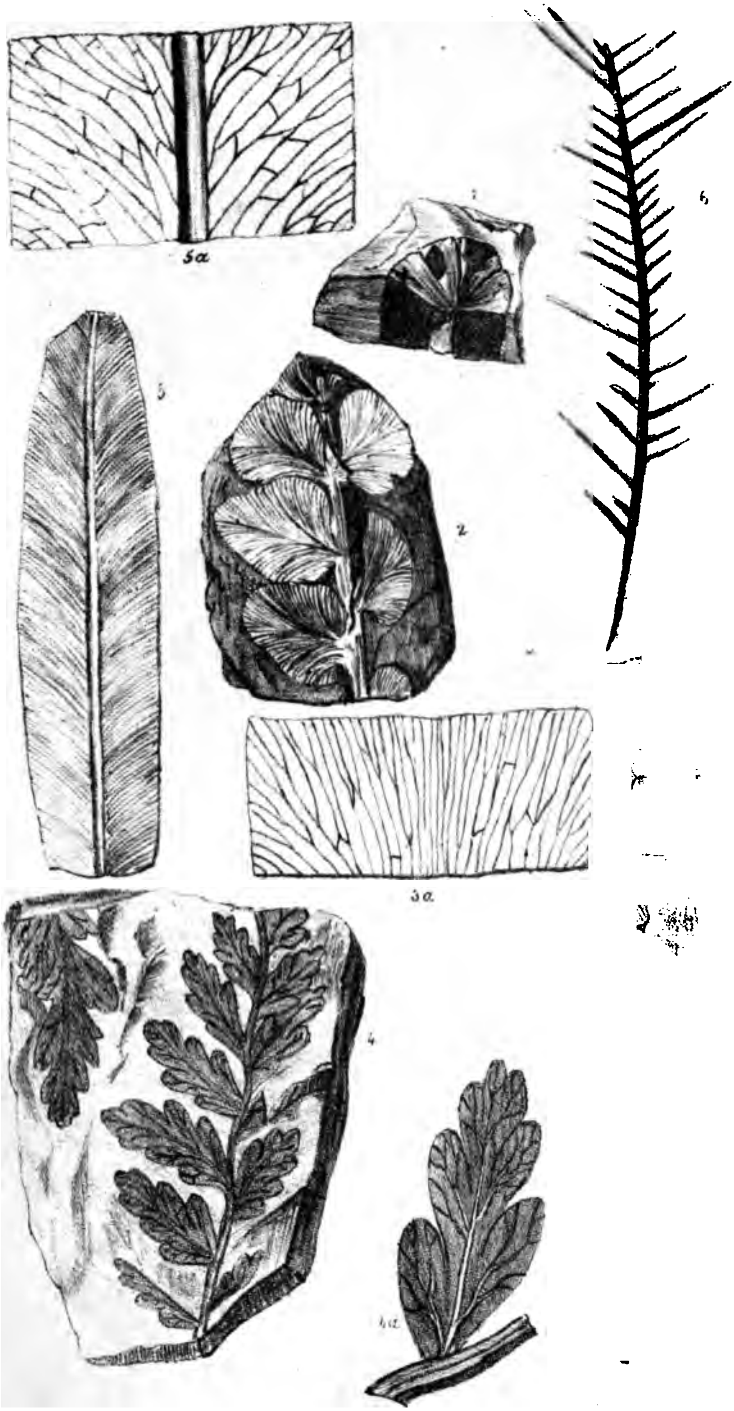

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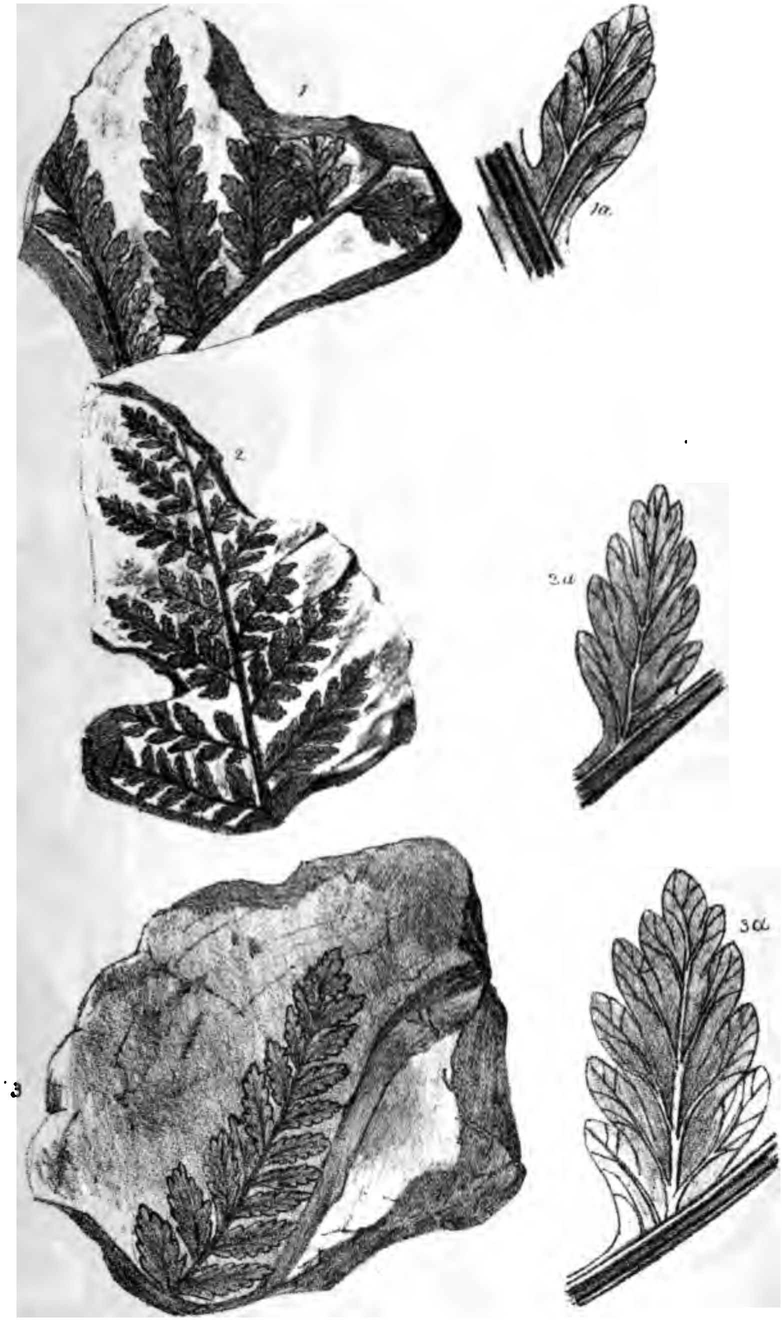

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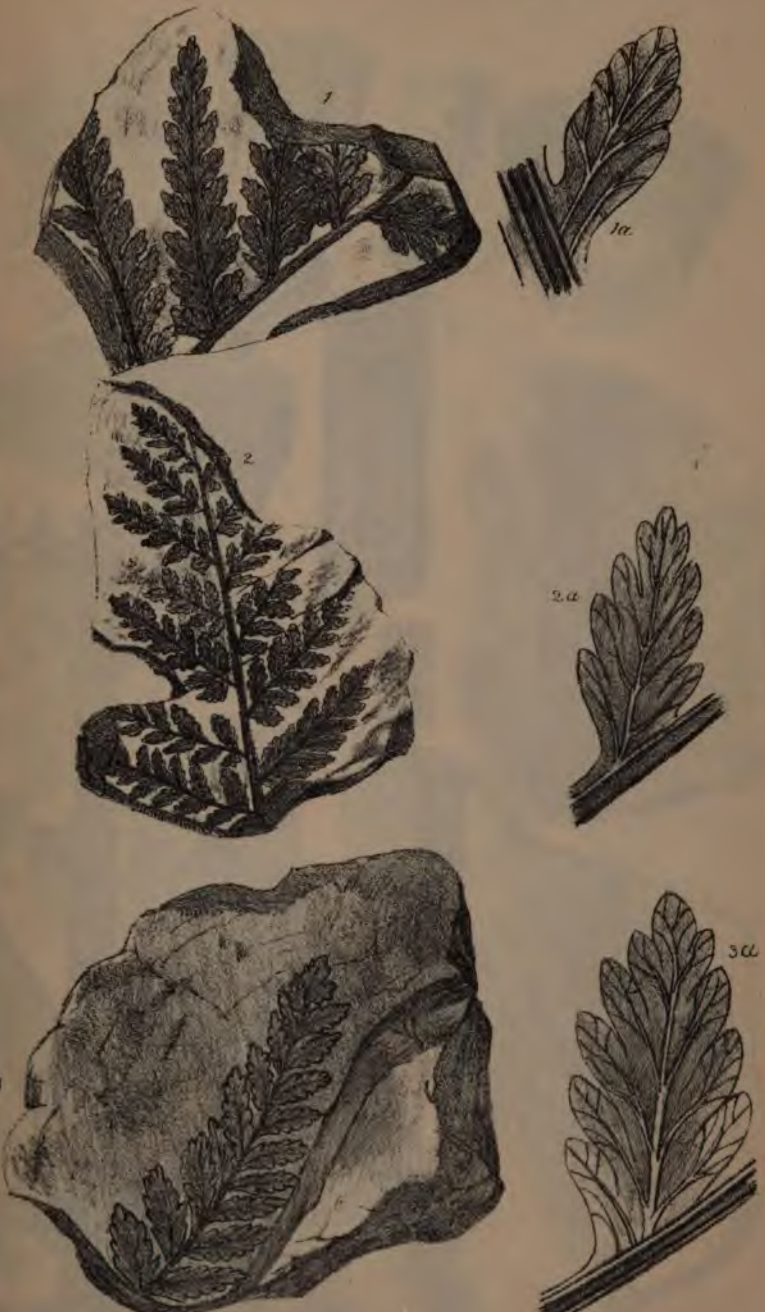

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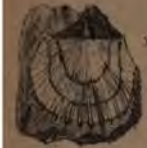
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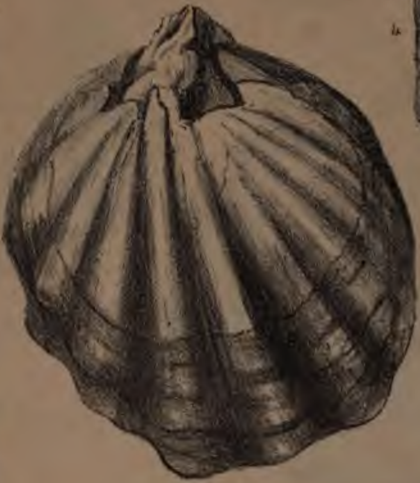
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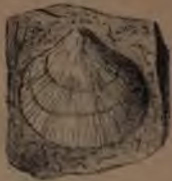
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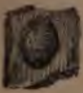
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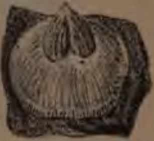
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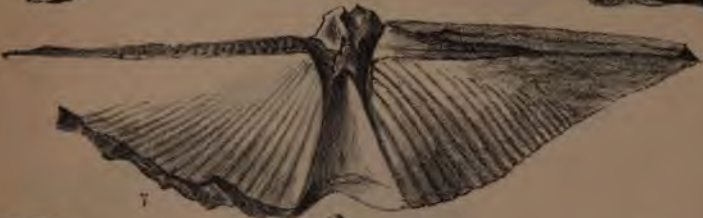
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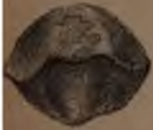
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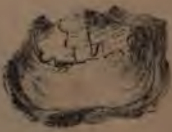
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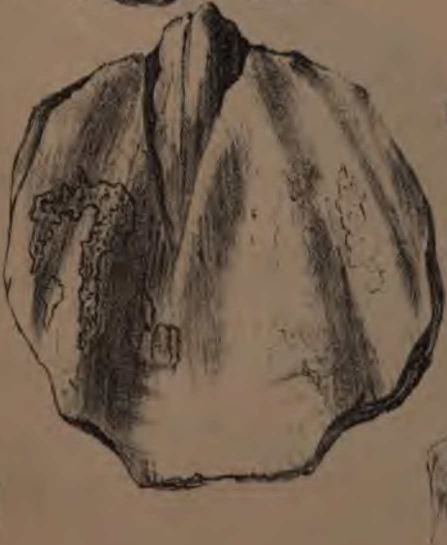
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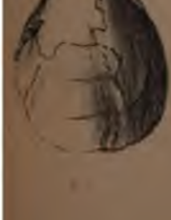
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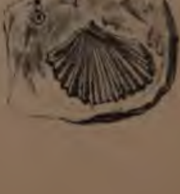
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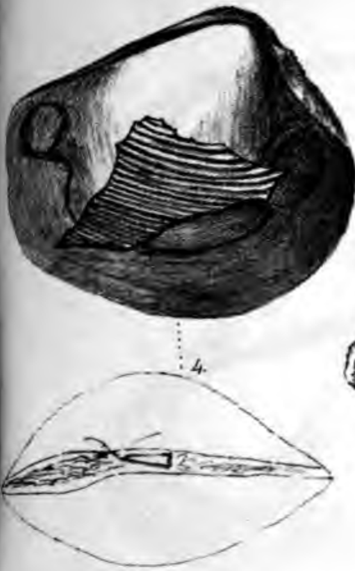

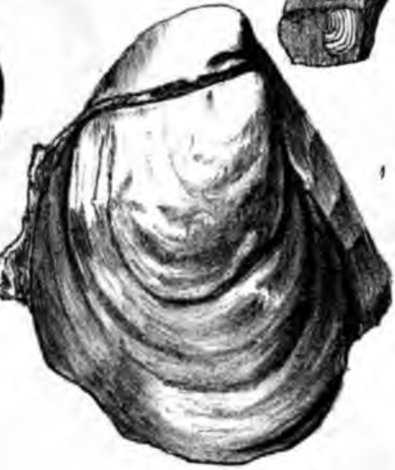

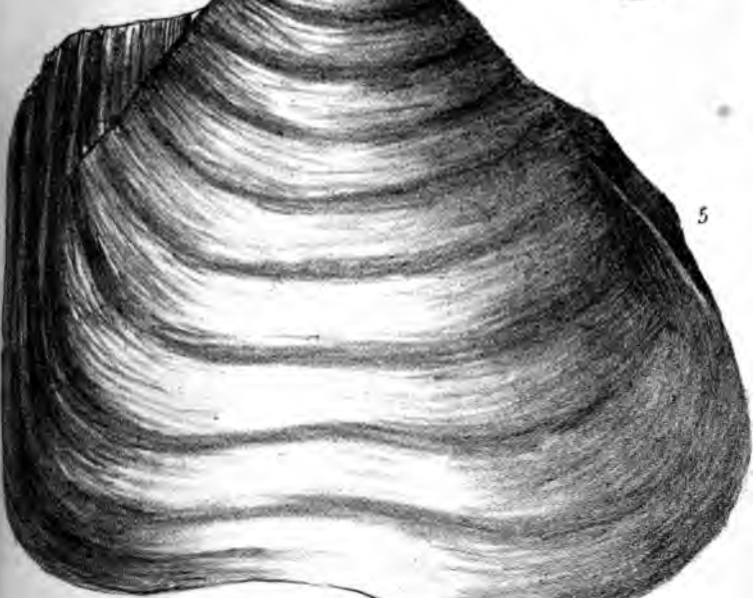

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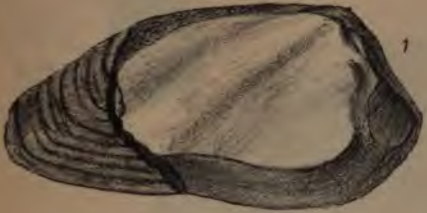

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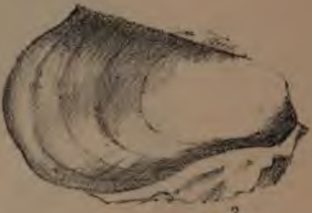

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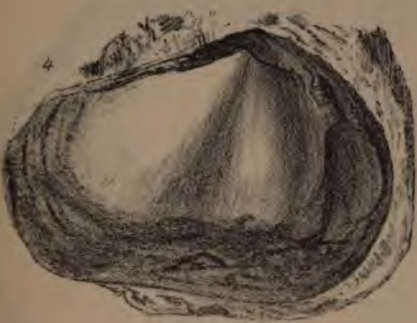

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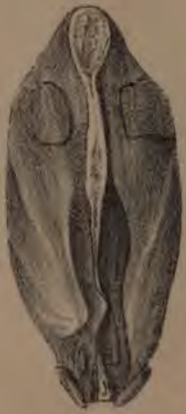

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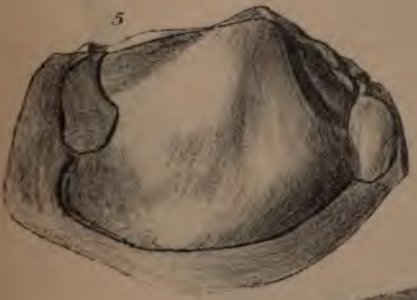

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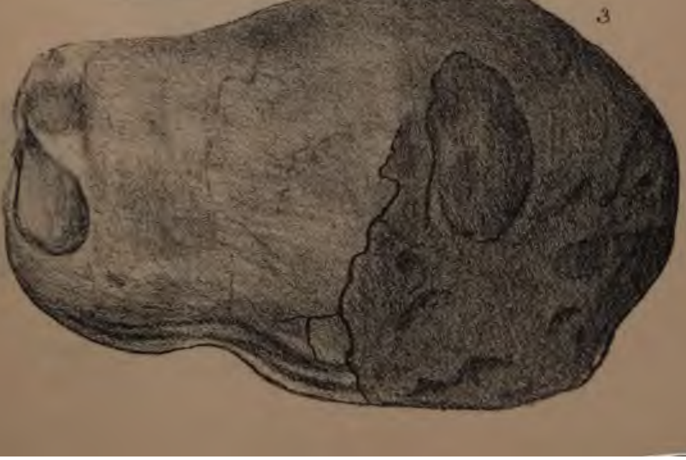

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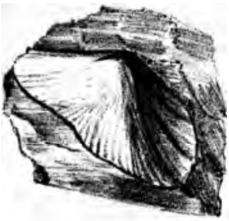

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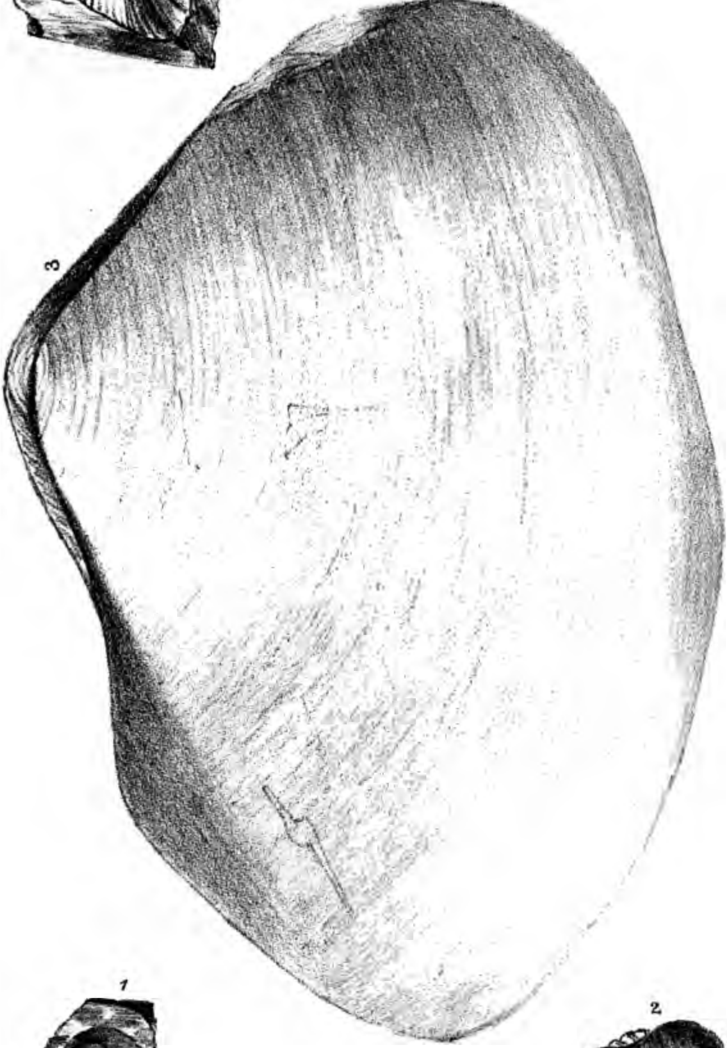

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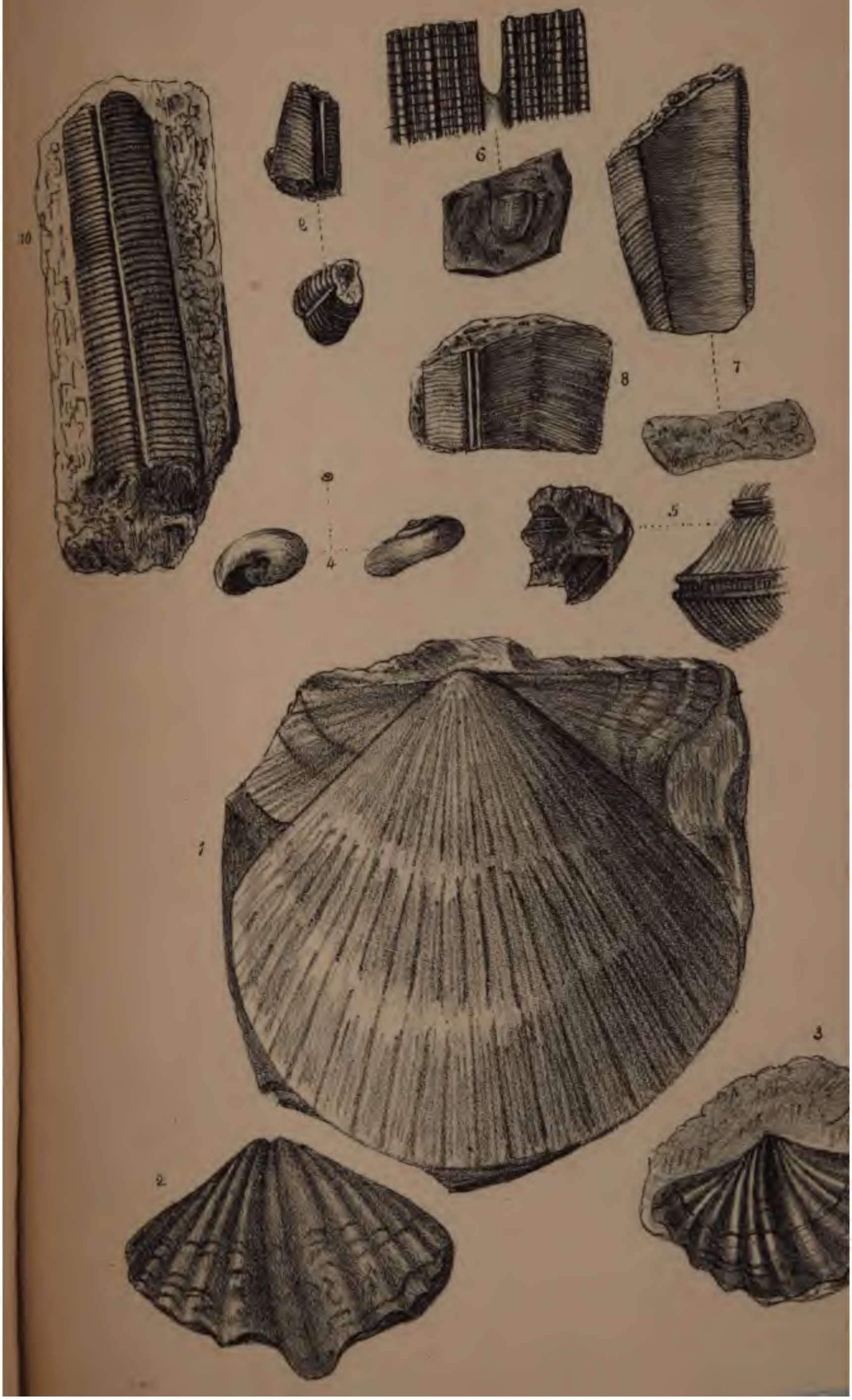

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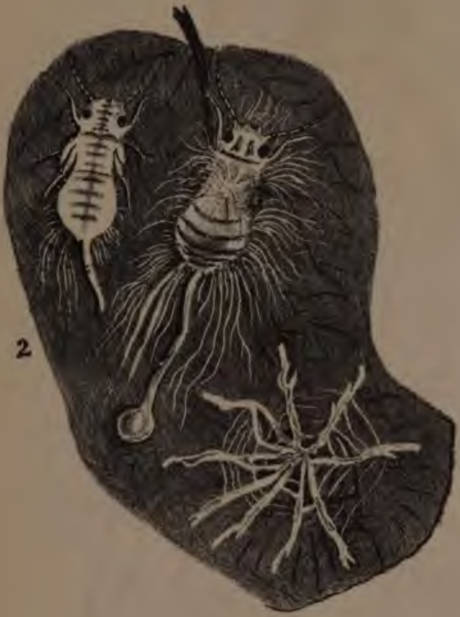

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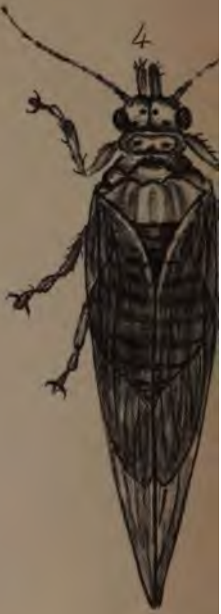

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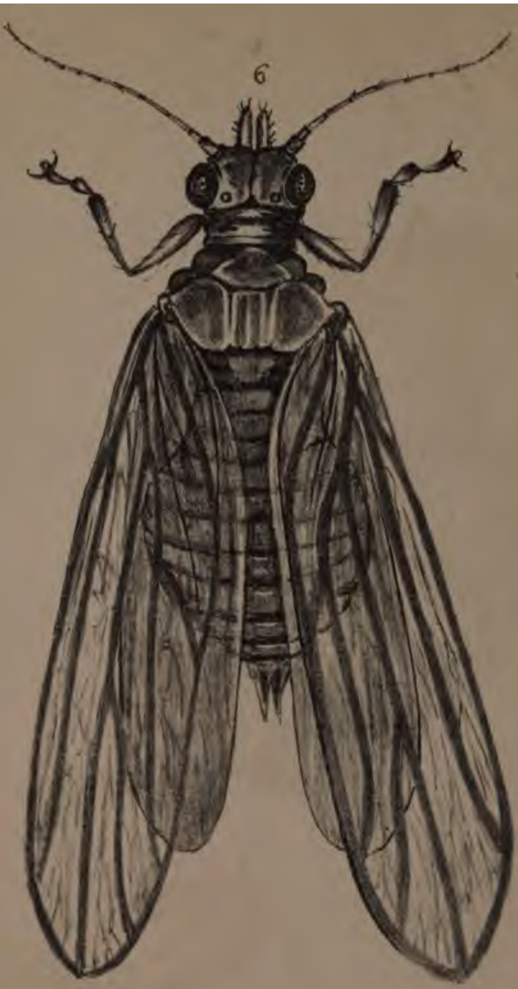

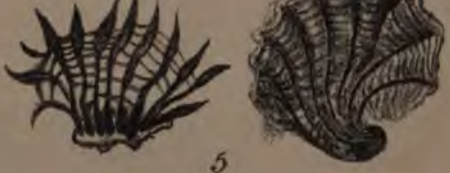

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ROBERT OFFICER, Esq.

Members of Council.

SIR J. L. PEDDER.*
J. E. BICHENO, Esq.*
REV. DR. LILLIE.*
JOSEPH HONE, Esq.*
JOSEPH ALLPORT, Esq.
JOHN ABBOTT, Esq.
DR. OFFICER.
JAMES BARNARD, Esq.
LIEUT. SMITH, R.N.
G. W. WALKER, Esq.
PETER FRASER, Esq.
C. T. SMITH, Esq.

Treasurer.

JOHN DUNN, Esq., Junr.

Secretary.

JOSEPH MILLIGAN, Esq., F.L.S.

* Denotes the four Members who next retire in rotation from the Council.

FELLOWS

AND

HONORARY MEMBERS.

* Denotes Members admitted since the close of 1850.

Abbott, John, Registrar-General of Births, Deaths, and Marriages	*Hobart Town.*
Agnew, J. W., M.D.	„
Ainsworth, O. D., Brigade-Major	„
Akers, Lieut., R.E.	„
Allison, W. Race, M.L.C.	*The Macquarie River.*
Allport, Joseph	*Hobart Town.*
Allport, Morton	„
Anstey, Thomas	*Anstey Barton, Oatlands.*
Anstey, H. F.	„
Archer, William	*Cheshunt.*
Arnold, Thomas, Inspector of Schools	*Hobart Town.*

Barnard, James	*Hobart Town.*
Bedford, Rev. Dr.	„
Bedford, E. S. P.	„
Berthon, Benjamin	*Cross Marsh.*
Best, Henry	*Hobart Town.*
Best, Charles	„
Bicheno, J. E., F.R.S., F.L.S., Col. Secretary	*Hobart Town.*
Bisdee, J.	*Lovely Banks.*
Bishop, William, D.C.G.*	*Hobart Town.*
Bolton, Daniel, Lieut.-Colonel, R.E.	*Auckland, New Zealand.*
Boot, Thomas	*Hobart Town.*
Booth, C. O'Hara, Captain	*New Town.*
Boyd, James	*Hobart Town.*
Boyd, Rev. David	*Longford, Norfolk Plains.*
Boyes, G. T. W. B., Colonial Auditor	*New Town.*
Brewer, C. B.	*Hobart Town.*
Brown, Richard	„
Brownrigg, Rev. Francis	*Patterson's Plains.*
Buckland, Rev. J. R., B.A.	*Hobart Town.*
Burgess, Francis, C.P.M., M.L.C.	„
Burnett, John, Sheriff of Van Diemen's Land	„

Burnett, James Ludovic	*Hobart Town.*
Burnett, J. C.	*Launceston.*
Butler, Gamaliel	*Hobart Town.*
Butler, Henry	,,
Butler, Frank	,,

Carns, R. W., M.D.	*New Town.*
Carter, William	*Hobart Town.*
Chapman, T.D.	*New Town.*
Cheyne, Alexander, Capt.	*Hobart Town.*
Clarke, Andrew, Lieut. R.E.	,,
Clarke, Rev. W. B., M.A., F.G.S.	*Sydney.*
Cleburne, Richard	*Hobart Town.*
Collinson, Capt. R.E.	*Sydney.*
Cotton, Francis	*Kelvedon, Swan Port.*
Cotton, Major, Deputy-Surveyor-General	*Hobart Town.*
Cotton, Henry	,,
Courtenay, G. H.	*Port Arthur.*
Crombie, Andrew	*Hobart Town.*
Crooke, W., Dr.	,,
Crowther, W. L., Dr.	,,

Dandridge, J. S.	*Hobart Town.*
D'Arch, Henry, Coll. of Customs	,,
Davies, Venerable Archdeacon	*Longford.*
Dawson, Dr., Dep.-Insp.-Gen., Hosp. & P.M.O.	*Hobart Town.*
De Little, Robt.	*Launceston.*
Degraves, Peter	*Cascades.*
Denison, Alfred	*Sydney.*
Despard, Colonel, C.B.	*Hobart Town.*
Dixon, Joseph	,,
Dobson, John	,,
Dobson, Thomas	,, *High School.*
Douglas, Alfred	,,
Douglas, R.	,,
Douglas, William	,,
Dry, Richard, M.L.C.	*Quamby.*
Dunn, John	*Hobart Town.*
Dunn, John, junior., M.L.C.	,,

Elliott, William	*Hobart Town.*
Elliston, W. G.	,,
Evans, Francis	*Launceston.*
Evans, Michael	*Hobart Town.*

Ewing, Rev. T. J.	*New Town.*
Ewing, Rev. R. K.	*Launceston.*

Fenton, Michael, M.L.C.	*Fenton Forest.*
Fitzgerald, J. F.	*Hobart Town.*
Fleming, Valentine, M.L.C., Attorney-General	"
Foster, John	"
Franks, Wm., A.P.M.	*Fingal.*
Fraser, Alexander	*Hobart Town.*
Fraser, Peter, Colonial Treasurer	"
Friend, M.C., R.N., F.R.S.	*George Town.*
Fry, Rev. H. P., D.D.	*St. George's, Hobart Town.*

Giblin, Thomas	*New Town.*
Gibson, James	*Circular Head.*
Gill, W. H.	*Hobart Town.*
Grant, James	*Tullochgorum.*
Grant, James	*Launceston.*
Greenwood, Joseph, Capt. 91st Regiment, Major Brigade	*Auckland, New Zealand.*
Gregson, T. G., M.L.C.	*Risdon.*
Gresley, Nigel, Union Bank	*Hobart Town.*
Grey, Sir George, K.C.B., Governor-in-Chief	*New Zealand.*
Gunn, Ronald C., F.L.S.	*Penquite.*
Gunn, William	*Launceston.*

Hampton, J. S., Comptroller-General Convicts	*Hobart Town.*
Harrison, Charles	*Antill Ponds.*
Harrison, John	*Hobart Town.*
Hathaway, Elisha, United States Consul	"
Henty, Charles	*Launceston.*
Henty, William	"
Hepburn, Robert	*Roy's Hill, St. Paul's Plains.*
Hiddleston, John	*Hobart Town.*
Hone, Joseph, M.S.C., Ch.Q.S. and Com. Ct. Req.	"
Hopkins, Henry	"
Horne, Thomas, Puisne Judge	"
Hull, Hugh	"
Hull, H. J.	*Kensington.*
Hort, A.	*Hobart Town.*
Hurst, H. S.	*Eastern Marshes.*
Huxtable, J. A.*	*Hobart Town.*
Huxtable, W. J.*	"

Impie, A., H.E.I.C.S.	*New Zealand.*

Jeffery, Samuel	*The Observatory, Hobart Town.*
Jervis, J. C.	*Hobart Town.*
Johnson, John	"

Kay, Joseph Henry, Com. R.N., F.R S.	*Royal Observatory, Hobart Town.*
Kay, W. Porden, Director-General of Roads and Public Works	*New Town.*
Kermode, William	*Mona Vale.*
King, George, Com. R.N., Pt. Offr.	*Hobart Town.*
Kissock, Alex.	"
Knight, T. J., Ch.Q.S. and Com. Ct. Req.	*Launceston.*

Last, Major, 99th Regiment	*Hobart Town.*
La Trobe, Charles Joseph, His Honor, Superintendent, Port Phillip	*Melbourne.*
Leake, John, M.L.C.	*Rosedale.*
Legge, R. V.	*Cullenswood, Break-o'-Day.*
Lempriere, T. J., Assist.-Commissary-General	*Hong Kong.*
Lewis, Richard	*Hobart Town.*
Lewis, Neil*	"
Lillie, Rev. Dr.	"
Lipscombe, Frederick	*Sandy Bay.*
Loughnan, Francis, H.E.I.C.S.	*Hobart Town.*
Lowes, T. Y.	*Glenorchy.*
Lynd, Robert, Lieut., Barrack-master	*Auckland, New Zealand.*

Macdowell, Edward	*Hobart Town.*
Mackay, James Duff, Captain	"
Maclanachan, James	*Ballochyle.*
Maclean, George, C.G.	
Makeig, G. A.	*Hobart Town.*
Mackinnon, J. Mc. G. M.	*Selma.*
M'Naughtan, Alexander	*Hobart Town.*
Manley, E. J.	"

Mann, Gother	*Sydney.*
Mantel, Walter	*Wellington, New Zealand.*
Marriott, Venerable Archdeacon	*New Norfolk.*
Marshall, John	*New Town.*
Matson, George	*Hobart Town.*
Meyer, J., M.D.,	*New Norfolk.*
Milligan, Joseph, F.L S.	*Hobart Town.*
Milligan, A. M.	*Launceston.*
Mitchell, J., D.A.C.G.	*Hobart Town.*
Morrison, Askin	,,
Moses, Leopold H.	,,
Moses, Samuel	,,
Moss, Phineas	,,

Newman, F. W.	*The Royal Society's Gardens.*
Nichol, Robert	*Hobart Town.*
Nixon, Right Rev. Dr., Lord Bishop of Tasmania	*Boa Vista.*
Noyes, W. T., A.P.M.	*Swansea.*
Nutt, R. W.	*New Town.*

Officer, Dr.	*Hobart Town.*
Ogilvie, David	*Richmond.*

Palmer, Rev. Phillip	*Hobart Town.*
Parramore, W. T.	*Richmond.*
Pedder, Sir J. L., Knt., Chief Justice	*Newlands.*
Perry, Arthur	*Secheron.*
Power, Robert, Surveyor-General	*Sandy Bay.*
Procter, William	*Brown's River Road.*
Pugh, W. R., M.D.	*Launceston.*

Read, G. F.	*New Town.*
Richardson, William, C. S.	*Hobart Town.*
Ring, Joseph	,,
Roberts, John	,,
Robertson, William	,,